AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 8., No. 34. WEEKLY. | NEW YORK, AUGUST 22, 1885. | $2.50 per Annum. SINGLE COPIES, 5 CENTS.

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For Sale Everywhere by Newsdealers.

ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

W. F. Parish's Automatic Adjusting Top Saw and Circular Mill.

One serious objection to the use of a top saw is, that where the saws meet, there will be an off-set in the lumber, necessitating the edging off, and consequent wasting of, that portion made uneven by saws not meeting in a proper manner. In addition are the delays and bad work, caused through the unevenness left on cant being brought in contact with head block, base or standard.

The automatic adjusting top saw, shown with this, is designed to overcome this difficulty by the use of a self-adjusting or flexible saw guide, and a laterally moving saw adapted to be driven in opposite direction to lower saw. The lower edge of the upper saw projects below and to the rear of the upper edge of lower saw, whereby the kerf of the lower saw serves as a guide for the upper saw. The top saw arbor is adapted to move in a longitudinal direction (within certain limits), in combination with a self-adjusting guide.

Another general objection to top saws, that they obstruct the vision of the sawyer, is obviated by hanging the frame to the upper timbers of the mill, bringing both frame and arbor above the sawyer's line of vision, and entirely out of the way.

The method of adjusting the top saw to a large or small lower circular is complete and convenient.

A friction clutch top saw driving pulley on circular countershaft (so top saw may be stopped or started at will), with reverse tightener pulleys are hung, in basement of mill. If insisted upon, the above is furnished with hangings to be bolted to lower husk, or what is usually called top saw stands, on frame hangings.

The new circular husk is cast in one piece, and is fitted with heavy adjustable arbor boxes, chambered for air or water. These boxes are provided with oil chambers on each side of journals, also tallow recess in cap, so arranged that the tallow lies on top of journal and melts gradually while the arbor is running. The arbor is made of forged steel, and is finished 4½ in. diameter with 8 in. diameter heavy solid head, and has an adjustable arrangement for controlling end play to suit saw and carriage. Arbor pulleys are made with solid ends turned their entire surface and evenly balanced. Solid ends prevent dust and dirt from getting inside and throwing pulley out of balance. Lumber supports and saw guide and entire outfit have the latest improvements.

Manufactured by the North Star Iron Works Co., Minneapolis, Minn.

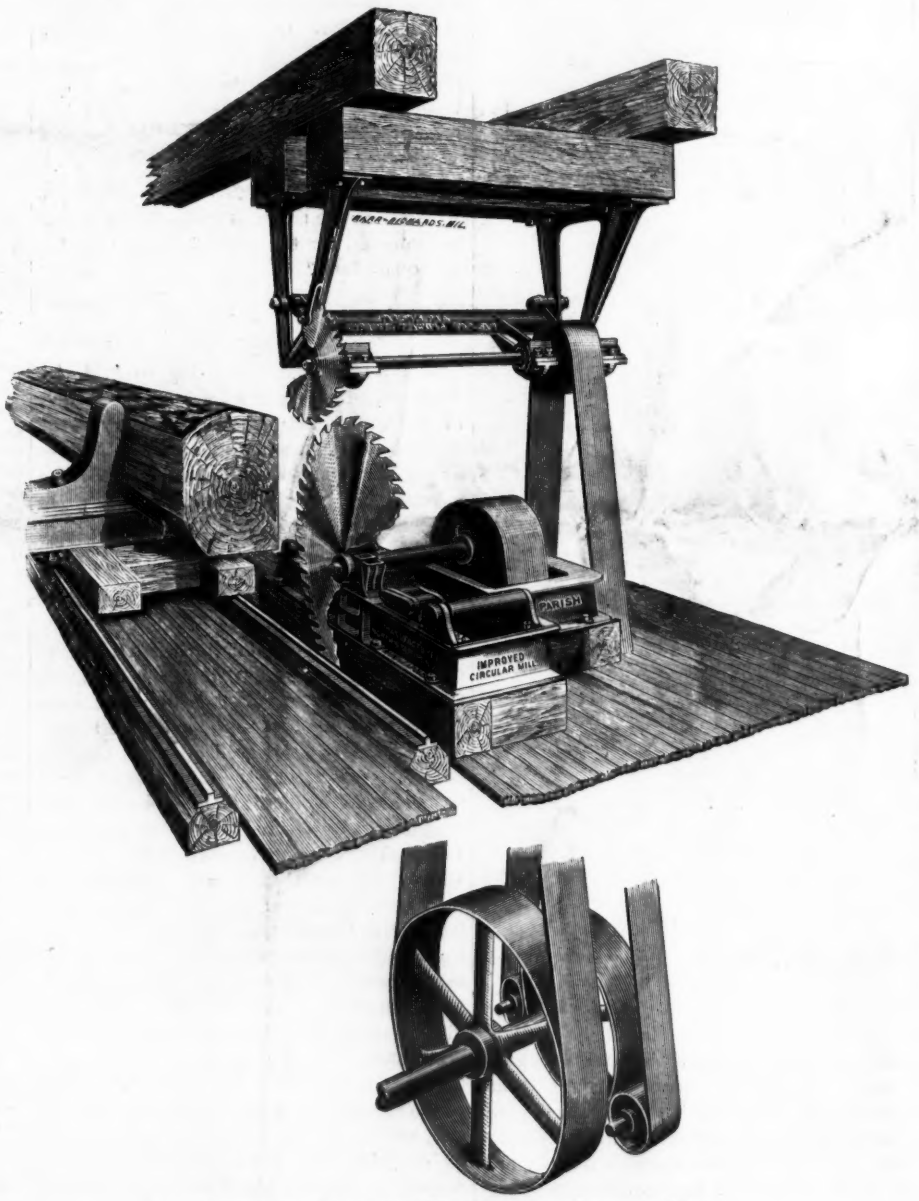
The American Association for the Advancement of Science will meet at Ann Arbor, Mich., August 26, and continue their session until Sept. 1. Prof. J. Burkitt Webb is chairman of the section devoted to mechanical engineering, and C. J. H. Woodbury, Secretary. It is expected that questions of more than usual importance will come before the Association for discussion at this meeting.

Early Engineering Reminiscences.

BY GEORGE ESCOL SELLERS.

FOURTEENTH PAPER.

The rapidly increasing traffic on the Pennsylvania road, even before the completion of the Portage and opening of the through line to the West, was sufficient to demonstrate the error that had been committed in constructing the Peter's Island incline plane. The inclines on the Portage might be sufficient for through trade for many years, but the local trade between Philadelphia and Halladaysburg, eastern end of the Mountain division, had increased to such an extent that it was evident the incline plane, at the Philadelphia end of the road, would soon be taxed beyond its capacity. Locomotives had not been in use on the road over one year before the delay to passenger trains became very annoying, and such pressure was brought on the Canal Commissioners that they ordered surveys to be made, with the object of substituting for the incline plane gradual grades that could be run with locomotives.



AUTOMATIC ADJUSTING TOP SAW AND CIRCULAR MILL.

The citizens were not idle; a branch road to avoid the plane was chartered, called the West Philadelphia Branch, a company organized, surveys made, and some little work done; financial trouble caused its suspension. Henry R. Campbell, then chief engineer of the Philadelphia, Germantown and Norristown R. R., was mainly instrumental in forming a company to build a branch to cross the Schuylkill river, at or near Morristown, and come into the heart of the city by the Germantown road. Much of this branch was graded, materials, including the iron, purchased, and on the ground, when the same financial troubles that caused the suspension of the West Philadelphia stopped this work; it was never resumed. The iron was sold by the sheriff.

Mr. Baldwin's first locomotive, built for the State, was put on the road in the spring of 1834. It was the third engine of his build, a six-wheel engine, one pair of drivers back of the fire-box, and a four-wheel swivel truck. If my memory is not entirely at fault, there were two English engines received about the same time, and Wm. Norris put on his first effective engine. This was also a six-wheeler, but differing from Baldwin's, in having the drivers in front of the fire-box, and of course a much greater weight on them. I think it was about the third engine of Norris' build, and the one that I have before referred to as having climbed the Peter's Island incline plane. I have no notes as to the grade of that incline, but my impression is that it was 1′ in 17′. There was nothing practical in running the locomotive and tender up this heavy grade, further than demonstrating the traction of plain wheels on the rails, but from it dates an entire change in American practical engineering. Wm. M. Roberts, identified as he was with the system of the Portage road, wrote for the particulars of this performance of the Norris engine, and from them he made elaborate calculations, verifying them by experiments on the Portage inclines. He came to the conclusion that grades up to 100′ per mile could be successfully operated with properly constructed locomotives, and even higher grades by the aid of an auxiliary or helping locomotive, and that any of our mountain ranges could and would be crossed without stationary power.

Mr. Welch, as chief engineer of the Portage, did not agree with Mr. Roberts in this, but in view of the increased business, which he foresaw must eventually press on the Portage, he had various plans to increase the capacity of its inclines, his favorite one being simply doubling the tracks and machinery. He was much annoyed by the persistent predictions of his assistant, Wm. M. Roberts, that with properly constructed locomotives heavy grades of 100 feet per mile, or even greater, would be successfully overcome, and with the aid of an auxiliary, or helping engine, be found more economical than the inclines with stationary power that had cost the State so much labor and expense; that long before the inclined planes would be taxed to their capacity they would be superseded by regularly graded roads. We all know these predictions came true, but the change did not take place as soon as Mr. Roberts anticipated, for he at that time thought it would be within ten years, but the planes continued in operation for a period of about twenty years, answering all the purposes for which they were intended, and, what is remarkable and speaks volumes in favor of their construction and careful operation during that time, without a single serious accident.

After the achievement of the Norris engine in climbing the Peter's Island incline there was much correspondence between Mr. Roberts and his friends in Philadelphia. I now regret that I have not preserved letters to them showing that at that early period he urged utilizing as much as possible of the weight of the locomotive for traction by connecting the wheels. In one of his letters he expressed himself about in this way: "I, as a civil engineer, make no pretensions to being a mechanical one, but I have satisfied myself that the power evolved in the steam engine is in all cases greater than the traction due to its entire weight, therefore as much as possible of it should be utilized for climbing the heavy grades necessary to overcome our mountain chains." Mr. Henry R. Campbell was one of the correspondents to whom I refer; he

took up with great avidity the use of heavier locomotives with a more even distribution of weight on the drivers, and increased traction; two or three years later he obtained a patent for an eight-wheel engine with four connected drivers and four-wheel truck, the type of the standard American passenger engine of the present time.

For building cars for, and the repair of locomotives on the old State road, shops were erected at Parksburg on the line of the road about 45 miles from Philadelphia, John Brandt was foreman of these shops; the title of master mechanic at that time had not been given. Brandt, as almost a self-taught man, a sound inventive mechanic and one of the locomotive pioneers of America, deserves more than a passing notice from me, and as I know of no one now living, unless it be my elder brother Charles, who can do this knowingly, I shall not attempt to condense it into this, but will devote my next paper to him and some of his works.

Modern Locomotive Construction.

By J. G. A. Meyer.

SEVENTH PAPER.

CYLINDER PROPORTIONS

To find the diameter of a cylinder-head bolt we must first know the initial steam pressure in the cylinder, that is, the steam pressure at the beginning or near the beginning of the stroke. We believe that 120 pounds per square inch for the initial steam pressure will agree very closely with the present practice, in which the tendency is to work with higher steam pressure than formerly. Assuming that 120 pounds per square inch for the initial pressure is correct, the diameters of the bolts for the cylinder head can easily be found.

For example, let it be required to find the diameter of the cylinder-head bolts, the cylinder being 16 inches in diameter, and the bolts to be placed about 5 inches from center to center.

The area of a circle 16 inches in diameter is 201 square inches; multiplying this area by the initial steam pressure per square inch, we have $201 \times 120 = 24120$ pounds; this is the force which the combined strength of all the bolts in one cylinder head must be capable of resisting, independent of the stress that is already placed on these bolts by the use of the screw wrench. Placing these bolts about 5 inches from center to center, we find that twelve bolts are needed. Dividing the 24120 pounds by 12, we have $\frac{24120}{12} = 2010$ pounds. This means that each bolt must be capable of resisting a pulling force of 2010 pounds.

The area of the cross section of bolt must be such that each square inch will have to resist a force of 5000 pounds, but as we have stated before, must not exceed this. But now the pulling force on the bolt is less than 5000 pounds, hence the area will also be proportionately less than one square inch. Therefore, to find the area of cross-section of the bolt we divide 2010 by 5000, and $\frac{2010}{5000} = .4$; this means that the area of the cross-section of the holt must be $\frac{4}{10}$ of a square inch, and consequently will be very nearly $\frac{3}{4}$ of an inch diameter. Adding to this diameter, twice the depth of thread, we find that the bolts for a 16-inch cylinder head should be $\frac{7}{8}$ of an inch in diameter.

Some master mechanics object to bolts in the cylinder head, and demand studs in place of them. Their objection to bolts is, that in case a bolt should break, the whole cylinder lagging (marked *R*, *R* in Figs. 12 and 13) must be taken off in order to place a new bolt in position. On the other hand should a stud break, that part left in the cylinder flange can be drilled out, without disturbing the cylinder lagging, and hence the preference for studs.

The cylinder lagging consists of strips of ordinary pine fitted around the cylinder, the thickness of these strips filling the whole space between the body of the cylinder and the outside of the flanges. The writer believes that a few thicknesses of asbestos paper placed around the cylinder, and then the remaining space filled with wood, as shown in Figs. 12 and 13, is the best practice.

Fig. 15, 16, 17, 18 and 19 show the thicknesses of metal in locomotive cylinder heads, cylinders and their flanges. These dimensions have been obtained by actual measurements of the metal in cylinders belonging to acknowledged first-class modern locomotives, and suitable for an initial pressure of 120 pounds per square inch. In these figures it will be noticed that the cylinder flanges are considerably thicker than those of the cylinder head; this is certainly a good practice, because in case a fracture should take place through some obstruction between cylinder head and piston, the break will occur in the cylinder head, and not in the cylinder flange; and thus, on account of the comparative cheapness with which a cylinder head can be replaced, costly repairs and vexing delays will be avoided, such as are sure to follow when the cylinder flange is injured.

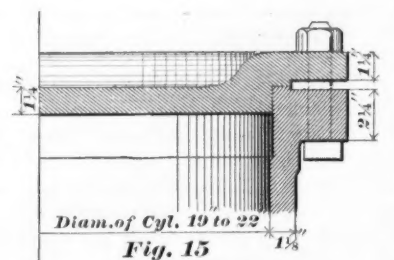


Fig. 15

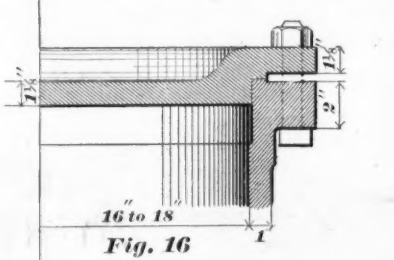


Fig. 16

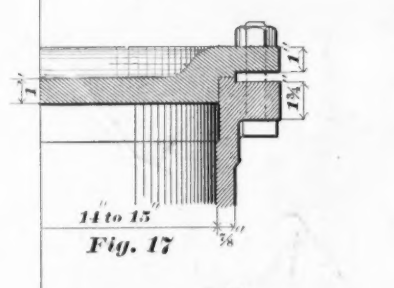


Fig. 17

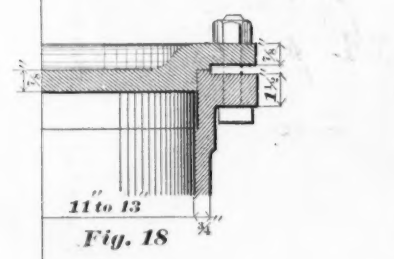


Fig. 18

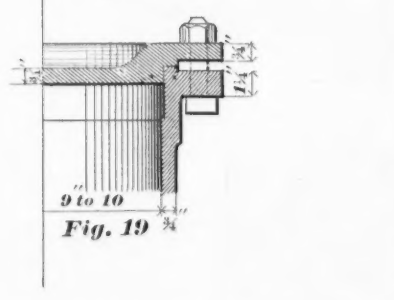


Fig. 19

In order to insure a good cylinder casting, the thickness of the bridges should be about the same as that of the cylinder barrel, and the thickness of metal around the exhaust passages, the steam passages, and sides of the saddle may be made about $\frac{1}{16}$ of an inch less for the smaller cylinders, and about $\frac{1}{8}$ of an inch less for the larger cylinders.

It sometimes occurs that in connection with railroads, ferry boats must be used in which the cylinders are very large in diameter. To determine the thickness of metal in these cylinders the following facts must be taken into consideration. first the thickness of metal must be such, that when the cylinder is subjected to the extreme steam pressure, fracture cannot take place; second, a sufficient amount of metal must be allowed for reboring; third, the cylinder must be sufficiently stiff to prevent jarring during the process of boring and planing; and, lastly, cylinders must be sufficiently strong to maintain their circular form. Rules for finding the thickness of metal in cylinders that will satisfy all the foregoing demands, have been given by a number of eminent writers.

The following rule 4, has been copied from J. D. VanBuren's book on "Formulas for the strength of the iron parts of steam machinery." In the writer's opinion this is the best rule, and will always give the proper thickness for all marine or stationary steam-engine cylinders. For locomotive cylinders the thickness found according to this rule will be rather light when compared with the thicknesses given in Figs. 15, 16, 17, 18 and 19.

Rule 4.—To find the thickness of metal in cylinders: Multiply the diameter of the cylinder in inches by the steam pressure per square inch, also multiply this product by the constant decimal fraction .0001; add to this last product the square root of the diameter of the cylinder in inches multiplied by the constant decimal fraction .15; the result will be the thickness of metal in the barrel of the cylinder. Or we may write this rule thus:

$$\left(\text{Diam. of cyl. in inches} \times \text{steam pressure per sq. inch.} \times .0001\right) + .15\sqrt{\text{diam. of cyl. in inches}} = \text{thickness of metal in cyl.}$$

Example 7.—What must be the thickness of metal in the barrel of cylinder, 49 inches in diameter, for 60 pounds' steam pressure per square inch?

$$(49 \times 60 \times .0001) + .15\sqrt{49} =$$

1.34 inch = thickness of metal.

Now let us find, according to rule, the thickness of metal in a locomotive cylinder 16 inches diameter. Assuming that the greatest steam pressure these cylinders have to resist is 120 pounds per square inch, we have

$$(16 \times 120 \times .0001) + .15\sqrt{16} =$$

.7420 of an inch,

that is, the thickness of metal in the barrel of cylinder should be $\frac{3}{4}$ of an inch, very nearly. Comparing this thickness with that given in Fig. 16, we find that the thickness found according to rule 4 is light; in locomotive cylinders it should have been 1 inch, as shown. By a little reflection we can discover the reason why the thickness of metal in locomotive cylinders should be more than in cylinders for marine or stationary engines. In locomotive cylinders more metal must be allowed for reboring than in cylinders for the other classes of engines, because in a locomotive the piston speed is generally very high, and besides this, in locomotive engines ashes accumulate around the exhaust nozzle in the smoke-box, and should then the engine be in motion with steam shut off (which occasionally occurs), ashes are sometimes drawn in the cylinder through the exhaust passage, and the consequence of such an evil, and the necessity of reboring, can easily be conjectured. Hence, the thickness of metal in a cylinder found according to this rule should be increased from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch for locomotive cylinders.

Decline of American Humor.

The Boston *Transcript* publishes some rather startling statistics on the "Decline of American Humor," in which it shows that newspaper wit was only able to discover eleven new subjects in the first four months of 1885, as compared with forty-four in the corresponding period of 1884. He notes also the almost complete disappearance of several jokes, such as the stove-pipe joke, which in 1875 reached the marvelous proportions of 2,664 paragraphs per month, while now, alas! its record is only 95 paragraphs per month in the whole country. The mother-in-law joke, the cake-of-soap-on-the-stairs joke, the oldest-Mason joke, and many other similar laughter excitants have gone the same dark road toward utter extinction. The *Transcript* should take heart, however, as the American people and paragraphers are by no means dead yet. For example, every day or two, we hear of the death of the oldest locomotive engineer in the country, and still he keeps on dying. By and by somebody will embalm this phenomenon into a permanent joke, that will, along with others, go far to re-establish the declining fortunes of American humor.

Form of Agreement for Apprentices.

In response to our inquiry for a form of indenture papers for apprentices, Mr. Jas. F. Meeker, of Elizabeth, N. J., sends us the following form through courtesy of Master Mechanic Wm. Woodcock:

Rules and Regulations for Minors entering into the service of the Philadelphia & Reading Railroad Co., to work in the shops of said company.

Minors employed by, and under instruction in the workshops of, the Philadelphia & Reading Railroad Company, shall come under and be subject to the following rules, until their term of service is completed.

1st.—If over the age of seventeen years upon entering the service of the Company, they shall serve the full term of four years; if under the age of seventeen years, they shall serve until they are twenty-one years of age. In case of absence during the term of service—unless such absence shall be occasioned by sickness—they shall serve such additional time as will make up for the time lost.

2d.—It is required of each to devote his whole time, during working hours, faithfully to his duty; those not observing these rules will be liable to be discharged.

3d.—The wages to be paid each person so employed, during his period of service, shall be as follows:

For the first year, 50 cents per day.
For the second year, 65 cents per day.
For the third year, 90 cents per day.
For the remainder of term of service, $1 per day.

Thereafter, upon the faithful fulfillment of his term of service, each shall receive, for the term served, the additional sum of 15 cents per day for every day worked by him over two years, and he shall also receive a certificate stating the particular branch of art he has learned, and his general conduct.

4th.—The right to discharge any such employe for indolence, negligence, or bad conduct (of which the superintendent of the company shall be the judge), is expressly reserved; and any one so discharged shall not be entitled to the extra wages to be paid, as herein provided, at the end of the term of service, to those who faithfully discharge their duties.

5th.—Should the company at any time see proper to suspend, wholly or in part, the work in their shops, the wages of such employes shall be suspended, wholly or in part, according to the circumstances, until the company shall give them full or partial employment. No wages shall be paid when work is wholly suspended; and should there be a partial suspension, wages shall be paid at the rates herein fixed, proportionate to the time worked.

6th—Minors in the service of the company will be required to improve themselves by reading, drawing, and attending evening school, when practicable, and will be liable to be discharged for misconduct at, or when absent from, the workshops.

This certifies, that I,..... entered into the service of the Philadelphia & Reading Railroad Company on the..... .....day of.....18.. That I hold myself subject to the foregoing rules and regulations, and agree honestly and faithfully to discharge my duties agreeably to the same.

Witness my hand at.....this .....day of.....18..

Signed in the presence of

.....
.....

I,.....being the ..... of the above named.....do hereby assent to his entering into the service of the Philadelphia & Reading Railroad Company, upon the terms of the foregoing rules and regulations, and do further agree that all wages earned by said ....shall be paid to him by the said company.

Witness my hand at.....this .....day of.....18..

Signed in the presence of

.....
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Rudolph Peter, of Torrington, Conn., an old subscriber to the American Machinist, has accepted a position as superintendent of a machine shop at Nettstal, Switzerland.

Technical Education and Apprenticeship.

In a paper read by Mr. Robt. Cunynghame before the Society of Arts, on Technical Education, the writer said:

"It is, therefore, incumbent on the friends of technical education to consider how it may be most economically carried out; and I believe it will be found that the solution of this question lies, not in attempting to replace workshop training by classes or lectures, but rather to supplement it by theoretical instruction. * * *

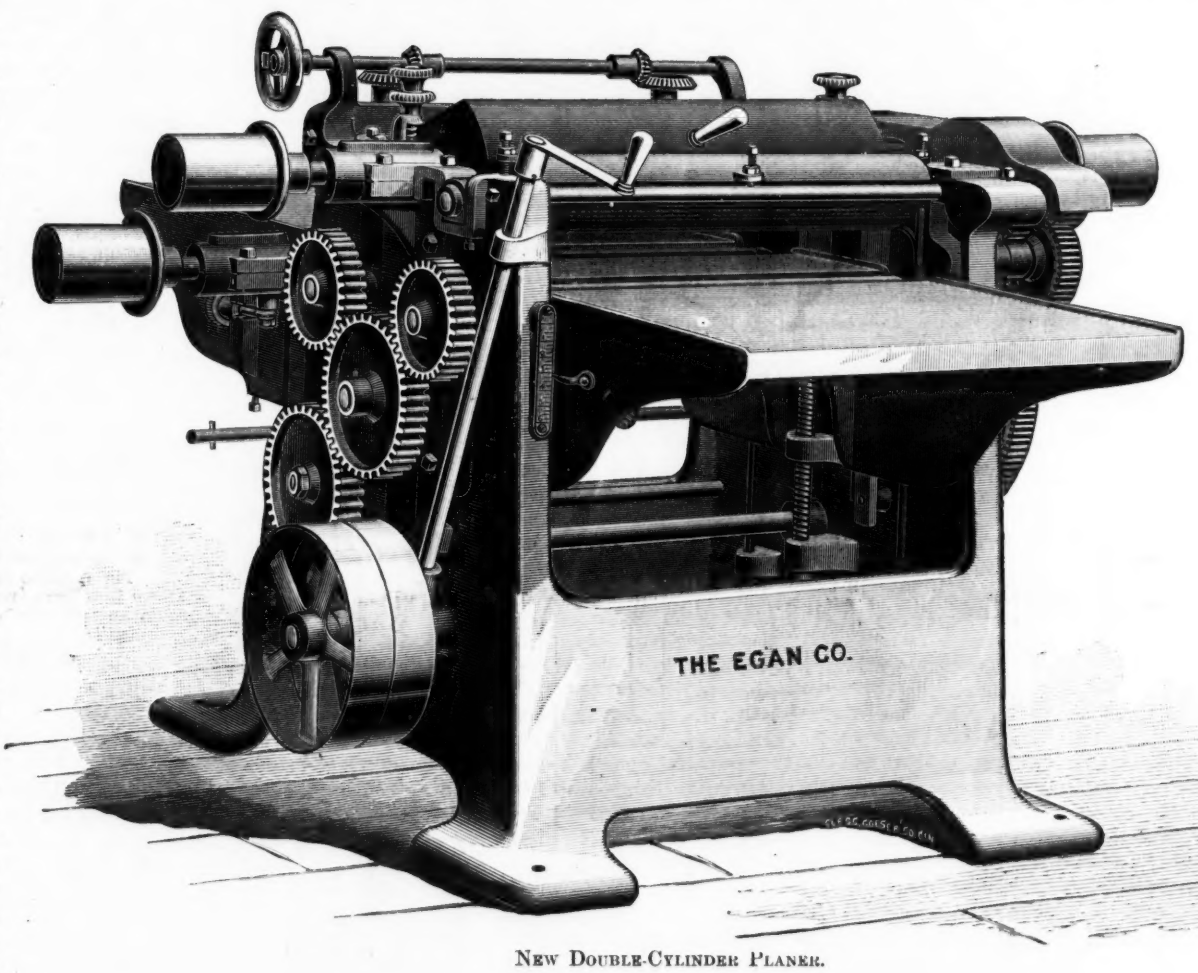
"Now, I think that all attempts at technical education will be imperfect that do not, to a certain extent, deal with the apprenticeship question. It is in the workshop that the artisan must be really formed—just as the barrister must be trained in chambers, or the doctor in a hospital. At the same time, what the university is to the advocate or medical man, the technical school should be to the artisan; only, however, with this difference, that it is generally necessary that while he is learning, the artisan should be also working, and that his technical instruction should go on contemporaneously with the workmanship employment."

Speaking of the bad influences brought to bear upon apprentices the author says:

"To counteract the evil I have spoken of, there appears to me no more useful plan than to form youths' institutes. The duties of the officials of these institutes should be to see to the apprenticing of boys, encouraging them to enter such trades as offer good prospects, and endeavoring to guide their choice. In all cases a month's trial without pay should be insisted on, and free liberty given to master and boy to refuse the proposed contract at the end of the time. There is no fear that under such conditions a boy will desire to change too often. At such institutions lists should be kept of masters desiring hands, and of boys desiring to learn trades. The character of the masters should be carefully investigated with a view to ascertaining whether they are fit and proper persons, or whether they have lately been bankrupt, and are likely not to be able to fulfill their engagements. Moreover, the boys should be periodically inspected, a monthly report being given by the master respecting their conduct; and, on the other hand, steps taken to compel the masters to stand fairly by their side of the contract."

New Double-Cylinder Planer.

The engraving represents a new machine of this type, brought out by the Egan Company, Cincinnati, Ohio. The points for which originality is claimed are the arrangement of the lower head, the gearing and the pressure bar. The lower head is on the bed, and has independent adjustment; it can be raised and lowered with the bed, or independently by means of a cranked handle underneath. The lower head is on the bed, and has an independent adjustment. It can be raised and lowed with the bed, or raised and lowered independently by a crank-handle underneath. The outer end of the bed can also be raised and lowed independently, to suit the cut being taken; and the part of the bed outside the head can be swung out of the way, giving free access for setting knives. The upper main head is of steel and double belted, and runs in self-oiling journal boxes, lined with babbitt. The feed consists of four geared feed rolls. There are no expansion links on this machine. The pressure bars are on each side of the knife and come very close up, enabling smooth work to be done. The loose and tight pulleys are 12x6½ in., and should run 900 revolutions per minute.



NEW DOUBLE-CYLINDER PLANER.

Questions About Natural Gas.

What is going to be the outcome of the remarkable discoveries and adaptation of natural gas as a fuel for industrial purposes, now going on in western Pennsylvania? How far will the limits of producing territory extend? Will its use give that region decisive advantages over other industrial centers? Will these advantages be neutralized in some other way? Will the supply of gas give out? These are questions on which large interests depend. Who can answer them?

The *Milling World* of Buffalo complains that a "lot of self-styled milling journalists met in convention and determined to boycott the *Milling World*." This action was undoubtedly naughty, but we don't see why our contemporary should make any fuss about it. We should suppose that if the millers and mill furnishers were pleased with its efforts to benefit them, the boycotting by other milling journals would not make twenty-five cents difference in their cash receipts.

An Accommodating Publican.

A friend, who says he has never been there himself, but who imbibed the information from an unquestioned source, has handed us a card, and given us some points regarding the doings of the proprietor of two establishments in New York City, which are worthy of notice. The goods dealt in are not of a highly moral nature, being liquors and cigars; but for seven years past the proprietor has set aside the day before Christmas in each year as "Employes' Day." On that day, not the profits of his two establishments merely, but the "entire gross receipts" are turned over to the employes and divided among them, in addition to their regular pay. In 1878 the amount so divided was $1,183.99; in 1879 it amounted to $2,562.60; in 1880 to $3,573.15; in 1881 to $5,163.39; in 1882 to $5,850.87; in 1883 to $7,406.59; in 1884 to $8,276.32.

The steady increase from year to year in the amount of business done on "Employes' Day" suggests that this increase was brought about by united and interested effort on the part of the employes, in the work of pleasing old customers and gaining new ones. It is fair to assume that these efforts have been rewarded with marked success on the other days of the year, the results inuring greatly to the advantage of the employer.

Last week, in his article on "Pay-Days and Early Closing," Mr. Richards said: "Saloon keepers, being fishers of men, are notoriously accommodating"—presumably to the customer. Here is an instance in which one has been accommodating to his employes with like results.

Tinplate pays no duty in Canada. In this country it pays duty "for revenue only."

The first fire-engine ever in Havana was built by David B. Hill, now Governor of this State, and Harrison Quigley. When a boy Governor Hill was always, in his leisure hours, engaged in constructing water-wheels, fire-engines, etc., while other boys were playing barbaree, base ball, and other games. —*Havana Journal.*

High and Low Speed Engines.

A few years ago the discussion between the advocates of high *vs.* low speed for steam engines was warm. At present we hear but little of it. It is apparent that both sides to the controversy have come to the conclusion that the truth was not all on one side; a very satisfactory conclusion. If it has been demonstrated that engines at high speed have given exceptionally good duty, it has also been shown that remarkably good results have obtained at low speed. By speed reference is had to number of revolutions; both sides to the controversy have always agreed upon the economy of fairly high piston speed, The truth seems to be that there is room for both high and low-speed engines, and that while in one instance one is better, in another instance the same is true of the other. Both types have their field, although it is not very clearly defined. This appears to be the verdict not only of intelligent engineers, but of steam users as well, and as such it will undoubtedly stand, at least until radical changes are made in steam-engine construction.

Inventors and Manufacturers.

Sometimes a really meritorious invention is brought out too soon, that is, before conditions are favorable for its reception. It used to be extremely unpopular, and equally unpleasant, to express a belief that the earth was other than a stationary body. Because it was true did not count anything against the fact that people did not believe it. So sometimes an inventor sees farther than he can bring others to see, and suffers by finding his invention fall flat. Men's minds move faster than formerly, and there is some hope that the unfortunate inventor may live to see his views adopted; otherwise his invention will, in the future, be re-invented, and someone curious in such matters, or particularly interested in this especial one, will establish a clear case of piracy against the last inventor, who probably never heard of it before.

Again, an invention may be good and needed at the time, but for lack of ability, financial or otherwise, it may not be pushed before the public as it should be. It does not follow because an invention that is not rejected outright does not become prominent or popular, that it is worthless, or even because it does become prominent, that it is of much value.

What is true of inventors is true in some degree of manufacturers of machinery. Machines that in time become popular are often introduced at a good deal of trouble and expense. Many become discouraged trying to bring something meritorious into use, seeing its utility themselves but unable to make others see it. Just how far to go in the direction of trying to create a demand is not easy to decide upon. Sometimes, in the case of something altogether good, it may be created quickly; sometimes only at the end of discouraging waiting, and much trouble and expense.

Have you ever stopped to think that the present depression has disarmed the great monopolies and corporations, and made them humble suppliants for public favor? This is the rich man's period of hard times. There is more truth than fancy in *Puck's* recent cartoon representing the great monopolists as peddlers, peanut vendors, etc. Not that Vanderbilt, Gould & Co. are in danger of resorting to such means of gaining a livelihood, but simply that they no longer sing the chorus of "the public be d—d."—*American Miller.*

One of a recent batch of foreign subscriptions to the AMERICAN MACHINIST, including one from Java and one from Africa, "takes the cake" as the boys say, in one particular. It was from a native East Indian, evidently, in the presidency of Madras, his surname having *seven syllables* comprised in a single word, though his letter was in English and well written. The spread of mechanical knowledge is one of the greatest civilizing agencies of all. "Let your light shine."

The latest movement in the way of industrial education in England is in the direction of making it compulsory in the instance of the children of the "destitute classes." It would not work in this country.

New Steam Engine Governor.

We present on page 5 a perspective view and on this page a detail cut of a new governor designed for steam or other fluid engines, now being introduced by Schaffer & Budenberg, 40 John street, New York. It is designed for use on the better class of throttling engines where close regulation is essential, and on automatic engines of the Corliss and other types upon which fly-ball governors are used.

In this governor the centrifugal force of the balls is not employed to make the required changes in the position of the governing devices, the duty of the balls being simply to indicate by their position the need of change, and to move a small balanced valve a very short distance; this valve admits steam to either side, as required, of a small piston, which, by its operation, makes the change required for uniform speed. The end gained by relieving the balls of their usual duty is the reduction of friction to a minimum, thus removing the usual impediment to their finding the proper position to correspond with the changes necessary to be made to keep the engine at correct speed. Being thus relieved of work and shock the governor can be made very sensitive as to changes of speed, which is essential to close regulation.

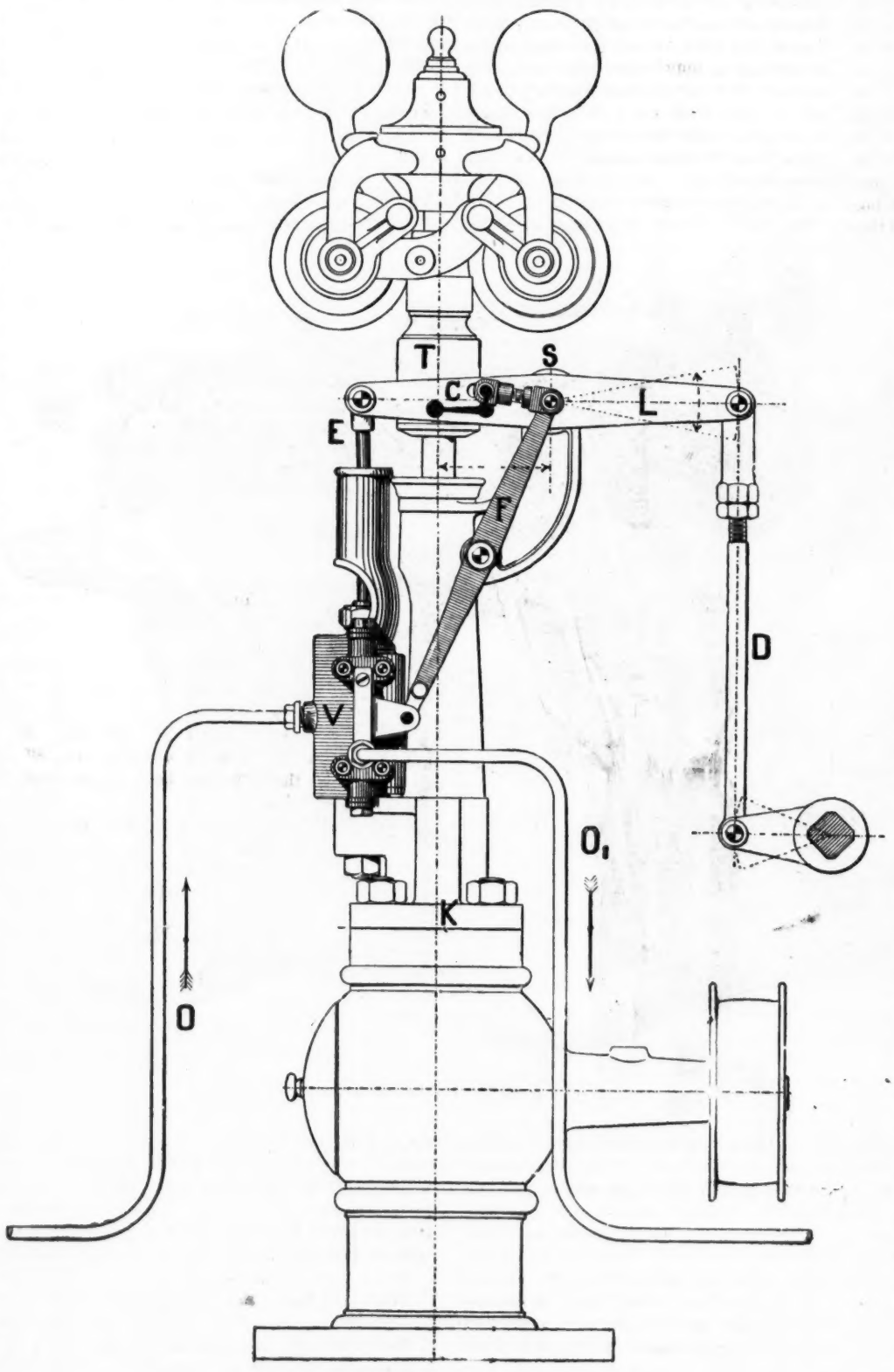
The action of the balls has only to move the small balanced valve previously referred to through a distance scarcely perceptible.

In operation the governor proper gives, by a change in position of the balls, a rising and falling motion to the sleeve *T*. The lever *L* consists of two bars, one passing each side of sleeve *T*; this lever is fulcrummed at *S* to an arm extending from the governor standard. Between the arms of lever *L* is a small bell-crank lever suitably connected with the sleeve *T*. From the vertical arm of this bell-crank lever a pin extends through a slot in one of the arms of lever *L*, this pin being connected by the short link shown below *S* with the inclined lever *F*. This link is made so as to be shortened or lengthened by right and left hand screw threads. The lever *F* is fulcrummed to a stud projecting from the governor standard, and is connected at its lower end by a small bell-crank lever with the small steam valve mentioned, which controls the admission of steam to the small cylinder situated at *V*. *O* is the steam pipe and O_1 the exhaust pipe of this cylinder. The piston of this cylinder is connected by a rod with the lever *L*, at *E*.

If, when the engine is running, the speed increases beyond that for which the governor is adjusted, the sleeve *T* is raised, which operates through the mechanism as explained to admit steam beneath the small piston, which acting on the lever *L* makes, through rod *D*, the necessary change in the governing device—either the throttle valve or cut-off mechanism. A reverse motion of sleeve *T* brings about reverse motion of the parts.

By the action of the steam above or below the small piston the lever *L* would be thrown to its extreme position in either direction, were provision not made to avoid it. What is wanted is that this lever should, by the operation of the piston, be moved to the exact position indicated by the position of the governor balls. This end is attained through the action of the bell-crank lever between the arms of the lever *L*, and which is actuated by the sleeve *T*. This action is such, that as soon as the necessary change indicated by the position of the governor balls has been made, the motion of the admission valve is reversed, thus effectually preventing over-action.

The details of this governor are well worked out, and its construction good.



DETAILS OF NEW STEAM ENGINE GOVERNOR.

Improvement in Boiler Construction.

We conclude the report and discussion of this subject at the Master Mechanics' Convention.

FLUES.

The Committee recommend the use of steel flues, set with copper ferrules brazed to the flues.

In regard to securing they say:

The securing of flues is now an almost uniform practice, viz., parallel, expanding with roller expander and beading the ends over, the fire-box end being encircled by a ferrule $\frac{1}{16}$" or less thick, of soft iron or copper, preferably, brazed to the end of the flue; but the distance flues should be spaced apart varies widely, the best evidence going to show economy in the wider spacing up to at least $\frac{7}{8}$-inch, and Mr. Fairies in 1875 (page 59), and Mr. Adams, on the North London Railway, make a good show for 1-inch spaces.

Mr. Sprague—"I would like to know somebody's reason for brazing thimbles on a flue. I have never done it, and have never seen any reason for doing it. When I first commenced to use thimbles it was the general practice to braze them on, but it did not look to me as if there was any advantage in it, and I put them on loose, and have always done so. The tendency would be to harden the metal, and that would be an objection and slight additional labor, and I cannot see where the advantage is."

Mr. Setchel—"In reply to Mr. Sprague, I would say that the more joints you have to keep tight in a fire-box or flue, of course the more trouble you have in keeping them tight. By brazing the thimble on, you do away with the very worst joint you have to keep tight, which is the copper with the rough flue. That being made tight the copper is easily adjusted to the small turned surface of the flue sheet. That is my theory."

Mr. Sprague—"I don't understand that, as a rule, they take any particular pains to make them tight. If they are not tight, the compressing on the flue to get this bearing on the sheet would have to compress that hard brazing, and the tendency would also be to make it loose and make the opening again the same as if it was not brazed on. That would be my judgment of the matter."

Mr. Swanston—"We put in all our flues in the manner Mr. Sprague speaks of. We made experiments and found quite an advantage in brazing, and we have continued it ever since, and it has been demonstrated that we can keep flues a great deal tighter with brazing than without."

The Chairman—"The experience of one member is that when he did not braze, the tubes expanded differently from his boiler, and the tubes played backwards and forwards in the ferrule, the ultimate result being, that with real good beading on the point of his tubes, he had leakage at that point, and got over it by brazing."

Mr. Lauder—"I suppose the practice would largely depend on the section of the country where the engines were used. In places where the water is good, I think either practice is well enough, but where the water is impregnated strongly with lime it probably allows the tube to become very much hotter than it otherwise would, and the tendency to push through the tube sheet is greater than where pure water is used. I apprehend in the eastern portion of the country, where the water is good, we would have no trouble with the thimble put on in the usual way, but on the Western roads, where the water is bad, I think they would have to braze it on."

Mr. Sprague—"I would like to know if there is anybody here using steel flues. That is something I don't know anything about. It seems to me that we ought not to recommend a thing that none of us know anything about."

Mr. Setchel—"I have used two or three sets of steel flues, and I have had very poor success in keeping them tight until we succeeded in welding what we call safe ends, and then we found there was no trouble in running steel flues. They make a very good steaming flue. You can use a thinner flue, and by employing a good safe end, you get a better steam boiler than you do when a thicker iron flue is employed."

Mr. Sprague—"I would like to ask how those flues were made. I suppose they were welded."

Mr. Setchel—"Seamless drawn tubes."

Mr. Sprague—"That would obviate any welding so far as the flue is concerned, but the way they are progressing now with seamless drawn steel tubes, I suppose it would be practical to draw steel flues seamless."

Mr. Whitney—I have used some that were welded in the ordinary way, and we have had no trouble in keeping them tight."

Mr. Hatchwell—We used steel flues, and we don't have any trouble in welding the steel flues, any more than we have with iron. We weld the steel ends on to the iron tube without any trouble, and they set just as tight.

Mr. Lauder—"I would like to ask what is meant by a steel tube with a safe end?

Mr. Setchel—"What I mean by a safe end is a piece about six inches long, made of the very best quality of tube iron, and about No. 10 wire gauge in thickness, something extra for the purpose of standing the riveting, and also getting a sufficiently large rivet to withstand the action of the fire in drawing the clinch. A steel tube, when you put that in the sheet, has so thin a surface that it will not hold the steel in the sheet. You must have something with more strength to it, and we use what we call a safe end for that purpose."

Mr. Lauder—"The object being to get a tube thinner than is possible with iron. I can see, then, readily the advantage of it. I think that is a proper statement of the reasons why the steel tube is recommended in preference to the iron.

HOLLOW STAYS.

The committee did not recommend the use of hollow stays, favoring the admission of air above the fuel by means of a fire-hole deflector.

Mr. Swanston—"We use a large 2-inch tube, and put about seven or eight inside, according to the size of the fire-box. We

think they are a very good thing, and we get along very well with them. There is no trouble in keeping them there that I see."

Mr. Setchel—"I would like to ask Mr. Swanston how his engine steamed?"

Mr. Swanston—"We think we get better results with the stays than without them. I put in the stays for that very purpose."

Mr. Setchel—"I don't like to do quite so much talking, but if nobody else will talk I shall have to. I believe it is not generally contended that these large tubes, put in the side of the fire-box, increase the steaming capacity of engines, but they are put in for the purpose of doing away with the smoke for passenger service. I believe this was the original design of the Pennsylvania Road, but I think it has been the experience of all on the Pennsylvania lines that it does improve the steaming of the engines, and perceptibly decreases the amount of fuel required. I know on the Ohio & Mississippi Road, when I commenced putting them in, it created considerable amusement for the boys. They thought the engine was going to be spoiled, but after the engine had been running a short time, they all wanted them put in their engines. I would like to hear the experience of any others that have tried them."

Mr. Hatswell—"I would like to ask if Mr. Setchel has experienced any difficulty with the flues leaking in using thosse hollow stays?"

Mr. Setchel—"No, sir.

Mr. Hatswell—"About two years ago I tried the experiment of using 2-inch flues—I did not call them stays—through the back end of the fire-box, right above the deck plate, and it worked very satisfactorily. It aided combustion, and did away with this nuisance of black smoke, and the engine was economical in the use of fuel. Then I put in another row in front, and it worked very well until last winter, when the cold weather came on, when the drawing of the cold air through these large flues caused leakage. I thought I would put a plate over and stop the leaking. I also experimented with a steam jet. I put it in the back, in the side, and in the front, and it did away with the black smoke. If you run the engine heavy, however, it had no control of it. So that, I concluded, was no benefit."

Mr. Lauder—"I believe in admitting air over the fire in any way will kill the smoke. It produces the combustion of the gases and prevents the smoke, but I think it destroys to a certain extent the steaming qualities of the engine. That has been my experience. Wherever air is admitted above the coal it will to a certain extent interfere with the steaming power of the engine, and consume more fuel."

Mr. Swanston—"That is now our experience with the ordinary tube placed pretty near the top of the fire, but I think it is our experience wherever the door is left open, and you try to control it by the door. The air is admitted away back from where the action of the draft is felt, and that cold air will blow into the top of the flues and probably lose steam; but with the tubes in the side of the fire-box we haven't any such result, and especially with a brick arch."

At the Washington Convention of the Master Mechanics' Association, Willard A. Smith, editor of the *Railway Review*, read a well-prepared paper on "Legal Requirements Upon the Mechanical Department of Railways." The conclusion was as follows:

"The law must sometimes step in to protect the improvident and reckless from themselves. Acting upon this principle, the Legislatures of several States have lately passed laws looking to preservation of life and limb, by requiring railway companies to adopt automatic couplers. State railroad commissioners are also making investigations with a view to urging still further legislation of a similar character. Whether the desired end can be attained or even hastened in this manner may be a matter of doubt. But there can be no doubt that it is due to an existing public sentiment, and that the tendency will continue and increase. It cannot be successfully resisted, and opposition will only intensify it. Railway officials can only successfully meet it by such enlightened action as shall make it superfluous and altogether unnecessary. The mechanical officers of railways have been engaged in this work of improvements for years, with manifestly great results in certain directions. To a certain extent they have been hindered and embarrassed by the lack of co-operation on the part of those superiors, whom financial considerations are the only things which can influence. The requirements of the law may make themselves felt by boards of directors, who are not inclined to listen to the arguments of those in charge of their mechanical departments. It may thus prove that properly-directed legislative action will overcome existing obstacles, and really give an impetus to mechanical improvement by clearing the way. If this be true, it is the part of wisdom not to antagonize the action of our legislators, but to endeavor to direct it into proper channels, and to place in their hands the most complete and reliable information on the topics which they are investigating."

NEW STEAM ENGINE GOVERNOR. (*See page* 4.)

Examination of Stationary Engineers.

BY JAMES F. HOBART.

In the AMERICAN MACHINIST of April 25, is published a list of questions to be answered by engineers when examined in competition for a certain situation. In the issue of June 27, Mr. Wm. J. Baldwin gives a list which is supposed to be the original list at said examination.

We wish all engineers in the United States were able to answer every one of those questions off hand. It would be a spendid thing for steam users if their engineers could do it, but we are afraid that Si, and Sam would have to figure a long time to get answers for some of the questions, and they would figure so busily that their boilers would get burnt, or fires go out, or the crank-pin get red-hot before they could begin to make the "figgers" come.

Not long since we had occasion to hire an engineer. He was required to run a 150 horse-power Brown engine, to look after the fireman, to take care of the steam that was used in three large lumber dry houses, and to be responsible for all the coal and wood which was brought to the fire-room.

We did not require our man to do any repairing when his engine was running. He was to make and use the steam, and do it to the best of his ability.

We advertised for "an engineer to take charge of a 150 horse-power steam engine. To a competent man, good wages will be paid." It seemed as if all the engineers in Massachusetts had turned out *en masse*. There were broken-down machinists, big stout machinists, big engineers, little engineers, and all kinds of chaps we could think of.

We "corraled" all the applicants in the mill and had Dan run them one by one into the engine room. We didn't take the poor fellows into the office, not a bit of it. Take Jake in the fire-room, and he is an intelligent man; corner the same fellow in your private office, and what is he? He is "flustrated," that's just what he is, and he can't tell a steam trap from a Keeley motor.

Our first question was: "How do you like that kind of an engine?" Then: "Did you ever run one of Brown's?" "What kind of an engine did you run last?" "How many horse-power did you call her?" "What kind of an engine do you like best?"

By this time the poor fellow had got over his "bashful scare;" he was not "stage-struck" any longer, and had found a place under his chair big enough to put his feet in. We went to work in good earnest then, and asked him:

1. "How long have you run engines?"
2. "How long have you fired a boiler?"
3. "How would you fire up a new boiler?"
4. "How long would you keep a fire in the furnace before you started steam?"
5. "If a new boiler leaked around the tubes, what would you do?"
6. "How would you get up steam on Monday morning, or after the boiler had been cold for a day or two?"
7. "What kind of a fire is the best, a thick or a thin?—with hard, soft, or 'slack' coal?"
8. "Do you run with water in the ash-pit?"
9. "Do you ever let ashes accumulate in the ashpit?"
10. "Do you wet down dry ashes while they are in the ash pit?"
11. "How often do you calculate to clean out your fires when burning one of slack, with three of Cumberland coal?"
12. "Do you stir the fire with a rake, or with a slice?"
13. "Do you shut your damper while you are working with the furnace doors open?"
14. "Do you keep the damper shut when disturbing dry ashes on bridge, or at back of boiler?"
15. "How do you clean the boiler tubes?"
16. "Do you favor a scraper, or steam?"
17. "How many gauges of water do you prefer in a horizontal tubular boiler?"
18. "Do you trust to water-line glass altogether, or do you use the gauge cocks also?"
19. "Do you ever clean out connections of the combination or water-line glass and gauge cocks?"
20. "Which inspirator or injectors are you familiar with?"
21. "Do you ever lift the safety valve to see if it is stuck?"
22. "How often?"
23. "Do you gauge the feed water to run all the time, a regular stream, or do you run water out of sight and then pump in a 2″ stream until glass is full?"
24. "Do you ever scrape the dirt off the fusible plug?"
25. "How often do you take out the manhead and inspect the boiler for scale, broken stays, etc.?"
26. "Did you ever knock in the hand hole cover at bottom of boiler?"
27. "Did you ever insert a torch on the end of a pole, and examine the bottom of shell for mud heaps?"
28. "Did you ever have plates over the fire-box sag from getting red-hot through absence of water caused by a pile of mud?"
29. "How 'low' would you let the water get before you drew your fires?"
30. "How do you bank a fire?"
31. "Can you tell good from poor coal by inspection of the same?"
32. "What kind of coal do you prefer for steaming purposes?"
33. "What kind of feed apparatus are you acquainted with?"
34. "Which do you prefer as the most economical?"
35. "If your pump gets hot and refuses to throw, what would you do?"
36. "State all the methods, with which you are acquainted, for making a feed pump return to duty, whether stopped on account of hot water, air, or defective suction."
37. "If your feed pipe should burst, what course would you take?"
38. "When steam runs up and blows off, how would you check it?"
39. "Should you close the damper?"
40. "Should you close the ashpit doors?"
41. "Would you, under ordinary circumstances, open the flue doors and allow cold air to impinge upon the boiler head, and into the tubes?"
42. "How long would you trust your steam gauge without testing, or having it tested?"
43. "What makes grate bars burn out quickly, and what treatment will preserve them a long time?"
44. "Do you allow clinkers to attach themselves to, and remain in, corners of your fire box?"
45. "How often do you 'blow off'?"
46. "Did you ever have experience with a surface blow-off?"
47. "Of what use is the surface blow off?"
48. "Under how many pounds pressure, per steam gauge, would you blow off a boiler?"
49. "Given a horizontal tubular boiler set in brick, 5′×15′. Query: How much time would you require after blowing off said boiler, before you would fill again with cold water, said boiler being blown off under 5 lbs. pressure on Saturday night, after a week's run, days only?"
50. "Is it advisable to empty a boiler immediately after the completion of a long run, or while bricks and boiler are both very hot?"
51. "What boiler compounds have you used?"
52. "If this boiler should scale, what course would you take?"
53. "Did you ever get drunk?"
54. "Do you drink?"
55. "Do you ever bring liquor to the engine room, either in your pocket, or in your stomach?"
56. "What papers do you read?"
57. "Do you read the *Police News*, and have your tool box full of them, or do you read a good engineering paper?"
58. "What should you do if a plain slide-valve engine should slip an eccentric while in your charge?"
59. "Could you set the eccentric, and adjust the valves?"
60. "What course would you take if you were suspicious that the crank-shaft of your engine had got out of line?"
61. "How would you test a wrist-pin to determine its truth?"
62. "Do you understand 'lead' and 'compression?'"
63. "Which do you prefer to secure the best results, in plain slide-valve engines, and in the Brown and other automatic engines?"
64. "Are you posted in the theory of the indicator?"
65. "Have you ever had practice?"
66. "Can you use the indicator intelligently?"

The above questions were put verbally. We want no written examinations for our

engineers. They are expected to decide and act upon the instant; they are not required to study out a way or the means of doing their duties; that is, they should do their studying before they attempt the practice of their vocation. We don't want a studying engineer when the regulator belt breaks, or when any accident happens in the mill. Then we want a man whose hands and brains can act together, and who never has to rub one with the other in order to get up steam in a case of emergency.

A man who cannot give a satisfactory answer to every one of the above questions, has no business in the engine room. The question about rum, coming as it did so sudden, was a puzzler to many of the applicants. They expected the rum question first, and had an evasive answer prepared, but the question did not come until they had forgotten to expect it; then, when it did appear, they were wrecked.

We are sorry to say that 38 men out of 52, could not give satisfactory answers to the three rum questions, and we carried the examination no further if they failed at this point.

There are lots of good engineers who drink rum, but there are many better ones who never touch it. Two-thirds of the boiler explosions may be attributed to too much steam, in fact, all may be so explained, but one-third at least may be placed to the credit of too much rum.

The use of the indicator is not to be used by any means as an exponent of the engineer's efficiency. Indicators cost more than most engineers can afford, and steam users are not yet educated up to a realization of the value of the indicator, but any man who is competent to take charge of a steam plant, is capable of saving more than his wages, by the free and intelligent use of the indicator.

LETTERS FROM PRACTICAL MEN.

A Primitive Electro-Magnet Engine.

Editor American Machinist:

I recently discovered among some old drawings a sketch of a magnet engine which I saw in operation in Boston a little more than forty years ago, which, at this day of electricity, may be of interest to some of your readers. The lively, energetic action of this little machine so interested me that I at once made a sketch of it, and subsequently (while at the Rensselaer School of Troy in 1839) I made a more complete drawing of the machine, the present illustration being a reduced copy of the same. It was a small affair, the rotating wheel, *a*, being only about five inches in diameter, the whole thing being composed of six electro magnets, viz.: three stationary ones, *c*, and three rotating, *d*, the rotating ones being fixed to the vertical shaft, *B*. The magnets were made of $\frac{1}{2}$" soft round iron with a sort of triangular head, as shown, and wound with a few turns of insulated copper wire near their heads as indicated by dotted lines.

The six magnets were all charged by a single battery about the capacity of a quart mug, the battery consisting of a copper cup containing several concentric circles or cylinders of zinc and copper alternately, requiring about a pint of dilute acid for a charge.

The alternate attraction and repulsion which caused the wheel to rotate, was brought about by six copper segments seen around the shaft, *B*, the segments having no metallic connection with the shaft. The ends of the wire covering the rotating magnets were soldered to the segments in such a way as to cause the continuous changing of their polarity six times in each revolution. Two copper springs, *e*, resting slightly in contact with the segments, served as conductors from battery to magnets, *d*, through the medium of the segments. The shaft, *B*, carried a small bevel gear which worked a larger gear, not shown, the proportion being about 1 to 12. The horizontal shaft which carried the large gear being smoothly finished and about $\frac{3}{8}$" in diameter, offered a good chance to test the power of this little machine. I saw no one capable of stopping it by grasping this shaft with a sinlge hand.

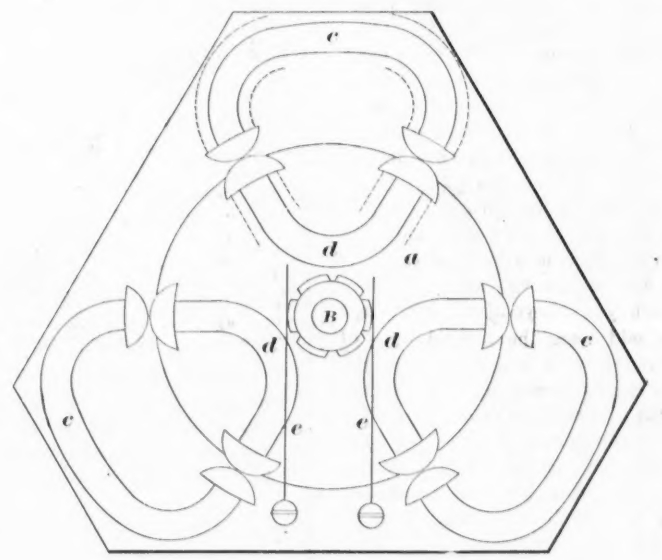
F. G. WOODWARD.

Fitting and Shrinking Large Couplings.

Editor American Machinist:

Shop methods vary with different shops, and, knowing this, I will describe the way in which a certain job was manipulated at the shop in which the writer was employed at the time.

Ten shafts, each 6" in diameter, were ordered with sleeve flanges—the sleeve to be 24" long and 10" in diameter, and the flange 36" diameter. The flanges were to be shrunk and keyed to the shaft. The flanges were all finished before the shafts came from the forge where they were ordered. The plan of preparing the flanges was as follows: Some hard-wood blocks were bolted to the face-plate of the large lathe, and bored so that the flange was a good fit; then, with clamps, the flange was fastened in this improvised chuck. The hole was first bored with a bar with a sliding head, two cuts being taken, bringing the hole within $\frac{1}{64}$ of the size required; then a flat drill, with sides faced with wood, was used as a sizing reamer. The holes thus produced were, as near as could be measured, round and parallel. Upon each sleeve two "spots" were turned, one of which was $\frac{1}{4}$" larger than the others. The object of this was to give the proper taper to the key-seat, which was planed, by using another extemporized rig. A pattern was hastily cut from a piece of 2" pine plank, and of a shape to make a V block, which should fit the ways of the planer bed. Two castings were made and planed up together, the bottom to fit the planer bed and the top forming large V's.



A PRIMITIVE ELECTRO-MAGNET ENGINE.

These were put on the ways behind the housings of the planer, and a flange fastened both to the bed and housings. A bar, with tool-slot on the end, was next fastened to the platen, which was loaded with pig iron to hold it down. With a "hammer feed" on the tool, the key-seats were rapidly and accurately cut. They had the merit of being alike, which is something.

The shafts were first accurately centered and faced off at the ends, and were then all "roughed out" to within $\frac{1}{16}$" of the required size.

For shrinkage it was decided that a hundredth of an inch was sufficient, and a solid collar that much larger than the hole in the flanges was bored. Each shaft was turned so that this collar was a "wringing fit" for the entire distance of the flange bearing. That the shafts should all be of this size was insisted upon, and this result was obtained.

The shafts and flanges being ready, a plan for heating was devised. An old cast-iron drum or cylinder, 24" in diameter and 33" long, was found on the premises, and was quickly converted into a heating furnace by breaking a door out of one side and elevating it over some grate bars. The flange (sleeve downward) was placed over this furnace, and a fire started. The draft was excellent, and in forty minutes the first shrink was made.

It was thought that the first one was a little hotter than really necessary, so the amount of fuel and time of heating were gradually lessened with the remaining nine until the last one was heated in fifteen minutes, and with less than one-half the fuel used on the first one. But this one was not quite hot enough, for the shaft stopped just $\frac{5}{16}$" from where it should have stopped, and the united efforts of six men, with a battering ram of 700 lbs. weight, failed to move it farther.

This may not be new to some of your readers, but it was new work and a new way of doing it to every one in the shop where it was done. If there are better or cheaper ways of accomplishing the results that were sought—if the amount of shrinkage was too much or too little—the writer would be glad to be so informed. The methods pursued were entirely original with the men doing the work, and for this particular case were, in the writer's opinion, excellent.

F. L. JOHNSON.

A Visit to a Modern and an Ancient Machine Shop.

Editor American Machinist:

I had occasion to visit a town where wide streets, good walks and fine lawns greeted the eye, large elms with wide-spreading branches gave shade, thrift, enterprise, modern elegance and luxury, betokened frequent intercourse with the surrounding world. Large machine works gave employment to several hundred workmen, forming the principal industry of the community. A visit to the works revealed the fact that they were planned on a modern basis; fine tools, of the most recent pattern, an excellent subdivision of labor, so that standard work was turned out at a minimum cost. There was nothing to condemn but everything to admire, and I congratulated the superintendent on the excellent system, beautiful designs and fine workmanship, which everywhere prevailed.

On my way to the depot, having a leisure hour, passing a small shop I entered, expecting to see graduates of the large shop engaged at some kind of special work. Passing through the main room to the blacksmith shop, a scene of rare interest met my gaze. An upright boiler near a corner, furnished steam for an engine of original construction; a line of posts ran through the center of the shop, to one of these the cylinder was bolted; the bearings of the main line of shafting were also bolted to the upper part of this line of posts, and to the end was attached a crank; the connecting-rod gave direct motion to the shaft, dispensing with a main belt; two round rods, serving as ways, were secured to the corners of the post; the crosshead, having a hole drilled in each side, went up and down with a wheezy, irregular motion; the whole covered with grease and dirt an inch thick, while an accumulation of many inches clung to the bottom and lay piled up about this thing of life. Near the rafters was suspended a blacksmith's bellows, a rope running down with a saddle stirrup for the blacksmith's foot; a molasses hogshead had been sawed in halves, one having been filled with dirt, doing duty as a forge—a lead pipe ran from the tuyere to the bellows—the other half was sunk in the ground and filled with water for the use of the smith; a barrel held the necessary tools. In this room, with a dirt floor, a large printing press was in process of erection; near by lay a cylinder of an engine, and many other useful articles, the collection, no doubt, of a generation.

Returning to the main room, the ideal workman, one that maketh the heart of man glad, was in his glory, with a pair of greasy overalls that had not seen soap or water for months, a string over one shoulder to hold them up, the round top of a plug hat having a small strip as a visor, short sleeves tightly rolled to the shoulder, seated upon an empty keg on the top of a chair, with face, hands and arms as black as the floor, his feet upon the chair rung, and whistling. Upon the ways of the chain feed lathe lay a dozen bolts centered with a punch, not drilled, while one was being turned in the lathe, this knight of greasy overalls held a pair of spring calipers in his hand, which he occasionally jammed over the bolt; the belt which was twisted many times, occasionally slipped, and a punch with the hand helped it along. On the bench lay a ten-inch cylinder for a horizontal engine, while the different parts lay scattered about the premises. Several ancient lathes, two power planers, a hand planer and a couple of drills completed the equipment for "repairing of all kinds," and to enable the proprietor to make "new machinery to order."

The floor of this Augean shop had not been swept for months, tools or stock had never been picked up, there was no place for anything and therefore everything was in its place; iron chips lay in great piles, water had sometime been sprinkled to lay the dust, and hills and valleys had grown up on the floor. Nearly half a score of men and boys were at work or trying to work. I have heard many things upon the platform of the dignity of labor, and read many well-written things to elevate the standard of work and workmen, but such a living burning example of the past, under the shadow of a brilliant specimen of modern enterprise, and in a New England town, I had not before seen. May its shadow grow less, till only its memory, as a link between the past and the present, remains.

LEVI K. FULLER.

Friction Clutches—Weak Lathe Feeds.

Editor American Machinist:

In the matter of friction clutches as discussed in the AMERICAN MACHINIST, it occurs to me that they are like a good many other things, they will work if they get a fair chance. In my experience I have seen a good many steam engines get into the same fix as the friction clutch; the engineer wants some other engine, or is incompetent to run a steam engine.

In one instance an 18"x42" engine was set up, and a man with a small bag full of references hired to run it. Every three or four days a part of it went to the machine shop for repairs. After about six weeks, the parties who bought the engine became so disgusted that they thought seriously of replacing it with another engine. But the builder wanted a chance to try and run it, and sent a man for the purpose. At the end of three weeks it was found that the engine had done its work satisfactorily, had lost no time, and no repairs had been done on it. A new engineer was engaged; result: no further trouble.

If friction clutches get into the hands of a man who has got sufficient ambition to oil a loose pulley, and to keep gum out of an oil hole, they will work.

If you buy a lathe of modern build, say a 24" swing, you will get for feed a belt about one inch wide, running on three-step cones, giving feeds from $\frac{1}{32}$" to $\frac{5}{32}$". If the cut is a heavy one, say on a 6" shaft, you will find, every few hours, the man at the lathe with a lace in his hand mending his belt. If the time lost in this way is noted, it will be found that the general result will be about the same, as if the belt had been put on the finest feed, and allowed to go along. Or if the belt is a strong one, if you watch it you will see it stop and quiver, then go on, the

tool digging in for a little, then the belt will stop a little and give the tool a rest.

To remedy all this, in one case the cones were taken off and thrown in the scrap, the end of the feed rod cut off, and the rod turned to fit the gears. In this way we have a lathe that will be an advertisement, good or bad, for the builder. The lathe had to stand up to $\frac{1}{8}''$ feed and $\frac{1}{4}''$ cut; if a 24" lathe will not do this it is not worth shop room. KID.

Trade Catalogues.

[From the *New York Sun.*]

"American illustrated trade catalogues excel all others in the world," said a printer yesterday. "No other country produces any in comparison. With them catalogue printing has become a wonderful and distinct business in itself. It is conceded by the most distinguished European art critics that Americans have surpassed all other nations in printing, and have well nigh done so in wood engraving. The great silverware houses of this city publish more costly and gorgeous catalogues than any other line of trade. They usually issue one edition of 7,000 copies, because they have about that many customers. One house on Broadway paid $100,000 for its edition of 7,000 last year, while other silverware houses paid sums ranging from $35,000 to $50,000. Another house, besides publishing a trade catalogue, issues a hand-book for its customers, at a cost of $6,600.

"The $100,000 catalogues were of folio size, and contained 400 pages. They contained about 4,000 words and steel engravings and photographic and lithographic sketches. Each book weighed about fourteen pounds. The big edition consumed forty-five tons of the finest and heaviest calendered paper, made expressly for the purpose, and of a higher grade than used in any other work of the bookmakers' art; twelve tons of cardboard and 3,000 yards of the finest silk cloth for the covers. The press-work alone for the 7,000 copies cost $3,000, and 210,000 sheets of gold leaf and 49,000 sheets of silver leaf were used.

"To print the covers of the books three colors are used. This requires the use of three different plates. The first prints the ground-work, and is worked cold, while the last two, which print in the gold and silver leaf, must be worked hot. Now, in heating these plates they expand one-fourth of an inch, so that allowances must be made for the expansion—a difficult job, indeed, when some of the figures are very minute, and an imperfect register would result in great loss.

"The lithographic work is the chief point of interest, for as many as fifteen tints are often used. In some catalogues a one-page design of three plates costs $1,200. One large house on Beekman street, whose goods include wash-basins made of chinaware with colored designs, pays $150 a page for plates. A publishing house up-town, which makes a specialty of issuing yearly a co-operative catalogue, charges $500 for a one-page design.

"The Hoffman House has got in press a catalogue that will cost $20,000. It will require 100 pounds of ink, costing $30 per pound, or $3,000 in all. It will contain sixty-eight pages, with sketches by Bouguereau, Corregio, Chelmonski, Etienne, Sadler, Ball, Schlessinger and Nast. The design of the book is by Charles Sibley May. The title will be 'A Cluster of Gems from the Hoffman House Collection,' which also conveys the idea of the book. The sketches will be full page, and will cost not less than $200 a page.

"In the more economical catalogues, such as those issued by the hardware, stove, locomotive, machinery and cutlery houses, there is no such expensive character of work, but they are printed in the best manner possible, on good surface book paper, and illustrated with the best wood engravings. The cost is often from $8,000 to $12,000 for an edition."

Just at this time there is a good deal of inquiry as to when electric motors are to have a trial on the elevated roads.

An English Apprentice Indenture.

Our correspondent, H. T. Roffe, of Atlanta, sends us an English apprentice indenture of 1867, which we copy below:

"This indenture witnesseth, that Henry Thomas Roffe (aged sixteen years), the son of Henry Roffe, of Wandsworth, in the county Surrey, engineer, of his own free will and accord, and by and with the consent and approbation of his father, testified by his executing these presents, doth put himself apprentice to John James Wentworth, of Wandsworth aforesaid, millwright and engineer, to learn the art, trade or business of an engineer, and with him, after the manner of an apprentice, to serve from the day of the date hereof until the full end and term of five years from thence next following, fully to be complete and ended.

"During which term the said apprentice his master faithfully shall serve, his secrets keep, and his lawful commands obey; he shall do no damage to his said master or his goods, nor suffer it to be done by others, but shall forthwith give notice to his said master of the same when necessary; he shall not waste the goods of his said master, nor lend them unlawfully to any, nor shall he do any act whereby his said master may sustain any loss, with his own goods or others, during the said term; without license of his said master he shall neither buy nor sell during his apprenticeship, nor shall he absent himself from his said master's service day or night unlawfully, but in all things, as a faithful apprentice, shall behave himself toward his said master and others during the said term. And the said John James Wentworth does hereby, for himself, his executors, administrators and assigns, covenant, promise and agree with and to the said Henry Roffe, his executors, administrators and assigns, that he the said John James Wentworth, his said apprentice in the art, trade or business of an engineer, by the best means in his power shall teach and instruct or cause to be taught and instructed, and also shall and will pay and allow unto his said apprentice for wages weekly, and every week in each year, beyond the first year during the said term the several sums of money following, that is to say, during the second year thereof seven shillings; during the third year thereof eight shillings; during the fourth year thereof ten shillings, and during the fifth and last year thereof sixteen shillings. All lost time, whether by sickness, or otherwise excepted. The hours of work to be from six o'clock in the morning till six o'clock in the evening. And a proportionate part of such weekly sums, for the time being, for any odd days of the said term, and for any one or more hours the said apprentice shall work beyond the usual working hours. And in case he shall at any time or times be employed beyond three miles from the shop, then at and after the extra rate of three shillings per week in lieu of lodging.

"And for the due performance of all and every of the said covenants and agreements, the said parties bind themselves by these presents.

"In witness whereof they have to this indenture set their hands and seals the twenty-third day of February in the year of our Lord one thousand eight hundred and sixty-seven."

Signed, sealed and delivered in the presence of

Benj. Hall. { Henry Thos. Roffe, [SEAL] Henry Roffe, [SEAL] Jno. Jas. Wentworth, [SEAL]

The *Locomotive*, published by the Hartford Boiler Insurance Co., says: "Concerning the explosion of a certain rendering tank which occurred last month, causing several deaths, the cause of which was a great mystery, one of our inspectors writes us: 'The digester was made of $\frac{3}{8}''$ iron, and was 74 inches in diameter. The iron was reduced by corrosion so that in several places it was but $\frac{1}{16}$ to $\frac{3}{64}$ of an inch in thickness. There was no safety valve on the digester, and after the explosion occurred the steam gauge on the boiler showed 125 lbs. per square inch, with the connections broken and steam escaping into the atmosphere, so that *before* the explosion occurred there must have been *over* 125 lbs. pressure per square inch on the digester, as there was no reducing valve between it and the boiler. The safety valve should have blown-off at 60 lbs., but it had been overloaded by the engineer so that it would not blow-off at 150 lbs.'

"Is it any wonder that under these circumstances the digester went to pieces, and took the building along with it? The only wonder is that it didn't go before it did, and further than it did."

Mechanics' Average Wages in Pennsylvania.

In his annual report for 1884, Joel B. McCamant, Chief of Pennsylvania Bureau of Industrial Statistics gives the following table·

"Being an exhibit of the average weekly wages of all wage-workers in the several industries of Pennsylvania named, supposing the annual amount of wages paid in each industry was divided equally among all the wage-workers in the special industry from which the annual wage fund is obtained."

Industries.	Weekly Wages.	Industries.	Weekly Wages.
Agricultural implements	$8 00	Iron foundries	$11 40
Axes and saws	8 80	Lasts	7 75
Bessemer steel	12 17	Milling, flour and grist	5 04
Blast furnaces	8 50	Malt	8 80
Bloomaries	8 12	Neckwear	7 25
Brass foundries	9 80	Ores, iron	4 80
Boilers and engines	8 56	Oil cloths	5 17
Bridges	9 00	Oil refineries	7 00
Boots and shoes	8 00	Paper	7 15
Breweries	12 00	Paints	9 33
Bricks, common	3 00	Planing-mills	8 00
Bricks, fire	6 00	Potteries	7 66
Brushes	3 30	Rolling-mills	8 00
Carpets	6 71	Saw-mills	5 29
Cigars	7 08	Slate quarries	6 10
Cotton cloth	5 10	Sugar refineries	9 25
Crucible steel	11 00	Soap and candles	8 20
Crucibles	16 60	Show cases	9 50
Cordage	5 80	Silk	4 00
Coal, anthracite	6 91	Shirts	5 00
Coal, bituminous	7 20	Stoves and ranges	11 00
Distilleries	8 20	Tanneries	7 50
Furniture	8 75	Trunks	8 00
Glass, window	11 50	Toys	3 64
Glass, flint and green	8 00	Terra-cotta	9 80
Glass sand	5 80	Type foundries	5 43
General machinery	9 25	Umbrellas and parasols	6 04
Hats and caps	4 00	Upholstery goods	6 16
Harnesses	8 00	Woolen goods	5 40

"The general average of the above would be (if we take into consideration the proportion of employes to the industries named in the table) about seven dollars and a half per week. This sum will not permit of any extravagant habits, and any diminution of it must inevitably compel the average wage-worker to abstain from the purchase of those necessaries of life which at the time seems most convenient to dispense with. To lessen the wages of a body of wage-workers is in effect to cause an "over-production," so-called, of manufactured products, since the average wage-worker, in order to meet the requirements of nature, and those wants incident to his station in life, must, in the event of a reduction of wages, either go in debt and satisfy those wants, or economize, and consequently leave the manufactured or other product in the hands of the dealer—hence an "over-production," which is but the result of an enforced under consumption."

William Kent, M. E., has issued a card to inform his friends that he has resigned his position with the Babcock & Wilcox Co., and has accepted the position of Secretary and General Manager of the United States Torsion Balance and Scale Co., 92 Reade Street, New York. He will also devote a portion of his time to professional work as consulting engineer in matters relating to steam engineering and the metallurgy of iron and steel. Mr. Kent does not lack energy or ability to do the work he undertakes. Those who were at the Atlantic City meeting of the American Society of Mechanical Engineers and heard him reply to the sharp criticisms of A. H. Emery on the Torsion Balance Co.'s Scale, need no further convincing that if anybody wishes to openly assail the merits of the new torsion balance he will find the General Manager ready to meet him more than half way.

American vs. Swiss Watches.

Several of the largest watch factories in this country have their representative agents in Chicago. The American watch industry a few years ago was in its infancy, and its rapid growth and development is one of the marvels of the day. Illinois has two or three watch manufacturing establishments, and in this city the manufacture of watch casings is an important industry. The time has gone by when an imported watch, even a Jorgensen, is considered indispensable as an accurate time-keeper. American watches are admitted to be as "faithful chroniclers of the passing time," as any watches made in the world. In speaking of Swiss watches Consul-General Cramer, writing to the State Department from Berne, remarks that since 1882 the export from Switzerland to the United States of watches and materials has suffered a steady decline.

The reason therefor is not because the Swiss watches are less good now than formerly (they still maintain "a good report"), but because of the rapid development of the same branch of industry in the United States during the past eight or ten years. American watches, in beauty and quality, successfully compete with Swiss and Jorgensen watches, not only in the United States, but also in Europe, and even in Australia.

The advantage the Swiss watch manufacturer has over his American colleague is the cheapness of labor. The advantage which the latter has over the former is that he, with his perfect tools and machinery, is able to produce a larger number of watches during a given period of time than his Swiss colleague, for the latter has much of his work done by hand labor.

While Consul Cramer does not wish the Swiss watch manufacturer and his employes to suffer from want of market for their articles, nevertheless, the interest every American citizen should feel for the success of the various industries of his country induces him to say that if our people would patronize to a larger extent than heretofore this particular home branch, much money would remain in the country and many more mechanics and laborers would find employment. It is not likely that American watches will find a market in Switzerland, but, with judicious enterprise and management, a market may be found for them in France, Germany, England, Austria-Hungary, Russia, the Danubian Kingdom and Principalities, and European Turkey, to say nothing of Australia and India.—*Western Manufacturer.*

A quasi railroad journal in drawing a picture of the troubles of railroad corporations, says, "A foolish labor agitation may send up the wages account and the item for fuel, anywhere from ten to twenty-five per cent." Where is the foolishness of such a labor agitation? It would be pretty hard to persuade workmen who have secured a ten to twenty-five per cent. advance of wages, by an agitation that there is anything foolish about it. If that editor wants to discourage labor agitations, he had better write in another key. Some of the railroad magnates who prompt the utterances of certain daily papers, ought to give him a few elementary lessons.

Since January 1 more than 5,000 Chinese have been landed in San Francisco from foreign ports. Under the restriction act of 1882, the number of Chinese who arrived at the port directly from China, in the period of twenty-three months was 6,746. The new restriction act, so-called, was approved July 5, 1884. Under this act in twelve months there have been landed 8,139 Chinese, or 1,400 more in one year than were brought in twenty-three months under the old act. Every day contributes some new dodge to the list of schemes for evading the provisions of the inoperative restriction act.

There seems to be more activity in railroad building in the South than in any other section of the country. A Florida paper says the Enterprise & Titusville Railroad is being pushed along rapidly, and trains will be running in the early fall. The Savannah, Florida & Western will build quite an extension. The Fort Worth & Denver City, in Texas, has just extended its line forty miles, and will extend it further. Many of the smaller roads are quietly extending.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Pres't.

JACKSON BAILEY, Vice-Pres't.

LYCURGUS B. MOORE, Treas. and Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

F. F. HEMENWAY, - - Mechanical Engineer.

The American News Company,

Publishers' Agents, New York.

The International News Company,

11 BOUVERIE STREET (Fleet Street), LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

DEALERS SUPPLIED BY

The American News Company, New York.
The American News Company, Denver, Col.
The American News Company, Kansas City, Mo.
The American News Company, Omaha, Neb.
The American News Company, St Paul, Minn.
The New York News Company, New York.
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The New Orleans News Company, New Orleans, La.
The Montreal News Company, Montreal, Canada.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton Branch, Clifton, Ontario, Canada.

SUBSCRIPTION.

$2.50 a year in advance, postage prepaid in the United States and Canada.

$3.50 a year to Foreign Countries, postage prepaid, except Bolivia and South Africa, to which the subscription rate is $4.50 a year, postage prepaid.

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Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

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☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

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NEW YORK, AUGUST 22, 1885

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General Causes for Industrial Depression.

Several special theories to account for industrial depression in this country have been advanced by the press both daily and weekly and argued with considerable earnestness. Few of them have taken into account the fact that industrial depression now exists in every civilized country of the world, in most of them to a greater degree than in the United States. Certain newspapers have ascribed the main cause of dullness in business to our protective tariff, and upon this assumption have persistently assailed the policy of protection. But when asked, if such is the case, why the business depression is greater in free trade England than with us, they dodge the question. Still other newspapers (sometimes the same papers) declare strenuously that the great cause of languishing industry is our silver coinage. When asked to explain, on this basis of reasoning, the cause of greater depression in half a dozen other countries where silver is tabooed, they turn a cold shoulder to the "pestiferous fellows" who bother them with such puzzling questions.

Some common cause must exist for general industrial depression. Special causes may operate in different countries, but it is not easy to determine beyond cavil what they are. There are general reasons for slackness in industries which operate throughout civilization. Changes in popular products and manufacturing processes which for a time throw large numbers of workmen out of employment have a tendency to cause a halt in industrial activity. When these changes are rapid and many of them radical, as has been the experience of the last few years, a season of quietude in great industries is likely to ensue. As soon as readjustment takes place and the improvements have been accepted by the people at large, a strong pushing forward of industries always follows. Remarkable industrial progress seems to be closely connected with heavy losses of capital and more or less enforced idleness of workmen. While the immediate effects are not pleasant, the ulterior benefits of improved processes and products are great both to proprietors and workmen.

A few years ago there were a number of large iron rail mills in this country with millions of capital invested, and thousands of workmen employed. Improvements in making Bessemer steel rails, brought about by Holley, Fritz and others, so cheapened and improved the rails that iron rails fell into disuse, and the making of them has ceased. This change has necessarily involved the sinking of considerable capital invested in iron rail mills, although many of these have been altered to roll iron for other purposes. Bodies of workmen in the mills have been made idle, and forced to seek other employment. As industries are mutually dependent upon each other, losses and idleness in any one of importance must exert an adverse influence upon others.

Steel is now being used in a great number of situations where iron was formerly wholly employed. The benefit is great, but incidentally some parties interested must be squeezed in bringing about the change.

Varying fashions in dress have a far-reaching influence upon the manufacture of textile fabrics. Occasionally some branch of textile manufacturing is almost entirely stopped, and expensive plants reduced in value more than one-half before their owners can take steps to prevent the loss.

It may be argued that, as radical changes in industrial methods and results are constantly being made, they could not cause a depression at one time, while having no such effect at other times. Causes, however, often work for a long time before their effects are visible to all. No industrial depression comes suddenly. The approach is by degrees, and may be foreseen by those who study the real signs of the times. A turning over of productive processes may not be universally felt in causing dullness until it has run through all the greater industries.

Such causes of depressed industry as we have above indicated are not by any means confined to this country. They are coexistent with civilization itself. They may cause depression sooner in one country than in another; but with modern facilities for reciprocal trade with all nations the effects will soon spread, wherever like causes exist.

A correspondent wishes to know the arrangement used for heating locomotive tires by gas to remove them. If some one will send us a sketch of such an arrangement we shall be under obligations to him.

The Secretary of the Treasury Wants Information.

The circular issued by Secretary Manning to manufacturers, asking for information regarding the workings of the tariff, cannot be objected to, because it does not cover the ground sufficiently. There are, however, only five specific kinds of information wanted. No. 1 asks for sample or samples of the article manufactured. If the product be locomotives or marine engines it might not be convenient to send a sample by mail. No. 2 goes right down to the foundation of manufacturing, thus:

Cost of production of a given unit of quantity by weight or measure, with the following details as to each kind or quality of the articles, viz: (A) cost of materials, character of same (as, for example, if wool, the kind of wool), whether of foreign or domestic origin. If foreign, what part of the value represents duties paid thereon. (B) Cost of labor in detail, giving each item specifically, and the rates of wages paid. (C) Operating expenses and how distributed. (D) Interest. (E) Other elements of cost not covered by the above.

The only item we could suggest including in the above schedule, is the manufacturer's own cost of living, but perhaps this is included in "other elements of cost." A manufacturer who can answer the above fully and satisfactorily must certainly have the details of his business ciphered down finely.

No. 3 asks for a description of buildings, and machinery and amount of capital invested in each.

No. 4 is:

If the foreign article of similar kind and quality is subject to ad valorem duty, state as nearly as practicable the specific equivalent per a given unit of weight and measure.

No. 5 is another modest request:

Mention any exceptional element of advantage or disadvantage in manufacturing, such as location of the factory with reference to market or means of transportation, accessibility of supplies, nature of the power or kind of machinery used, character of labor employed, rates of wages paid, amount of taxes, or exemption from taxes, &c.

If a manufacturer has any advantage over his competitors, let him write it down and send it to Secretary Manning.

General information as to the business compared with the same kind of business in Europe, is also requested. When the Secretary of the Treasury gets a few complete replies to his circular, he will know the whole inside working of the manufacturing business.

Boiler Inspection in New York City.

A question has been propounded to us by the engineer of a large establishment in this city using a number of boilers, which he says is "of the utmost importance to thousands and thousands of engineers." He wishes to know whether the steam-boiler inspection department of New York City has the power to send their inspectors to test the boilers, and shut off steam in a large manufactory, "when this action would entail a large loss at the time," or whether the date of such inspection is at the option of the boiler owner.

The law of 1885 provides as follows:

Every OWNER of a steam boiler, or boilers in use in the city of New York, shall annually, and at such convenient times and in such manner and such form as may by rules and regulations to be made therefor by the board of police be provided, report to the said board the location of such steam boiler or boilers, and thereupon, and as soon thereafter as practicable, the sanitary company, or such member or members thereof as may be competent for the duty herein described, and may be detailed for such duty by the board of police, shall proceed to inspect such steam boiler or boilers, and all apparatus and appliances connected therewith.

Every owner, agent or lessee of a steam boiler or boilers in use in the city of New York, shall for the inspecting and testing of such boiler, or each of such boilers, as provided for in this act, and upon receiving from the Board of Police a certificate setting forth the location of the boiler inspected, the date of such inspection, the persons by whom the inspection was made, and the limit of steam or pressure which shall be applied to or upon such boiler, or each of such boilers, pay annually to the Treasurer of the Board of Police, for each boiler, for the use of the Police Pension Fund, the sum of two dollars, such certificate to continue in force for one year from the granting thereof, when it shall expire, unless sooner revoked or suspended.

In order to get more definite information about the powers of the Boiler Inspection Department we wrote to the Superintendent of Police and received a letter from Washington Mullin, sergeant in command of Steam Boiler Inspection and Engineer Bureau. He says:

"I would respectfully state that chapter 160 of the laws of 1862 is entitled "An Act for the better protection of life and property," and is the law (with some alterations and amendments by subsequent legislatures), under which this bureau is now operating. This department being, to a very great extent, responsible for the safety and security of steam boilers operated in the city of New York, it is necessary that the strength and condition of the same should be determined at least once in twelve months. I enclose you a copy of chapter 437, of Laws of 1885, which makes some alteration in the original law, and wherein you will find that 'it shall not be lawful to have, use, or operate any steam boiler, without having first had it inspected and tested, and the certificate provided for procured.'

"Therefore it is within the power of this department to shut down and test any steam boiler within this city, when it is deemed necessary, and for the purposes of test; and it is the duty of owners, &c., to report the location of boiler, when ready for test, in the first instance; and any request made within twelve months from the date of the first inspection, to have boiler re-examined, so that the annual test may take place during the season when it is the more convenient for the users, we invariably comply with."

It would seem from the above that the law allows the inspectors a great deal of latitude, but we are informed by a lawyer to whom we submitted the question, that they must be "governed by general principles of law which are against all forms of oppression or needless annoyance."

By an Act of Legislature, boilers which are regularly inspected by the insurance companies are exempted from inspection by the police department. The insurance companies are compelled under penalty to make regular reports to the police department of boilers inspected by them.

The London *Ironmonger* in discussing the failure of John Roach says:

"His failure will almost stop the building of iron ships in America for foreign trade. The American builders are nearly all idle, being unable to compete with the British yards."

The *Ironmonger* should know that there are a few other iron shipbuilders in this country, some of whom have been in the business longer than Mr. Roach. It is almost impossible for them to be much duller than British shipbuilders are represented to be, in the columns of the *Ironmonger*. When a demand springs up for additional iron ships sufficient to create activity in British shipyards there will be considerable business of the same kind on the Delaware.

The Chicago Industrial Exhibition opens September 2. Efforts are being made to have a good display of machinery.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(245) F., Fitchburg, Mass., asks: Please tell me the length of the threaded part of pipe taps from ⅛″ to 3″, inclusive; also the outside diameter of large and small end? *A.*—There is no uniformity as amongst different makers in this respect, and no such thing as a standard. The small end of tap is always made a little smaller than the hole in fittings, and the large part a little larger than the outside of pipe; taper ¾″ to the foot.

(246) J. P., ——, asks: 1. How can I set a cut-off indicator on a marine engine? *A.*—By uncovering the valves and making the indicating device agree with the point of cutoff. 2. What is the cause of the crank journals of a marine engine running hot when everything is in line? *A.*—They may be too small; may be rough; bearings may be of poor material; perhaps when in motion the bearings are not in line; any one of a dozen causes.

(247) J. S., Philadelphia, Pa., asks: 1. What is meant by the law of moving pulleys? *A.*—The expression is new to us; we do not know what is meant by the expression. You will find the laws of motion explained in any work on natural philosophy. 2. What is the British unit of heat? *A.*—The British thermal, or heat unit, is the quantity of heat required to raise the temperature of one pound of water one degree, that is, from 39° to 40°. 3. What is the mechanical equivalent of heat? *A.*—One unit of heat equals 772 units of work. 4 What is Croton water? *A.*—The water with which New York City is supplied. It refers to the location from which the water comes.

(248) G S., East Stroudsburg, Pa., writes: I want to siphon water from a spring to the house, a distance of 5,000 feet. The perpendicular fall is 150 to 175 feet. In the first 1,500 feet from the spring the elevation (above the spring) is 27 feet. I want to draw, say, from 3 to 5 gallons per minute. Is it practicable, and what should be the size of pipe? I would like your opinion, and that of any of your readers who have had experience of this kind. *A.*—Our opinion is, that it is not practicable. If any of our readers have had experience in obtaining a constant flow of a small quantity of water over an elevation of 27 feet, and through a long pipe, we shall be glad to hear from them for the benefit of G. S., and others.

(249) P., Providence, R I., asks: 1. What is the rule for finding the strength of hydraulic cylinders? *A.*—There are different formulas in use. A rule derived from one is: Square the external radius; also square the internal radius: subtract the latter from the former, and multiply the remainder by the tensile strain the metal will safely stand (say about one-half its ultimate strength); use this last product for the dividend; add the square of the external radius to the square of the internal radius, and use this for the divisor; the quotient will be the safe working pressure. 2. What rule is used for finding the strength of steam cylinders? *A.*—See J. G. A. Meyer's article in this issue. 3. What rule is used for finding the horse-power of a belt? *A.*—Various rules. See AMERICAN MACHINIST of May 5, 12, and 26, 1883.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Air Compressors, Rock Drills. J. Clayton, B'klyn, N.Y.

Curtis Pressure Regulator and St'm Trap, July 4, p 15

Edw. Sears, wood engraver, 48 Beekman st., N.Y.

Presses & Dies, Ferracute Mach. Co, Bridgeton, N J.

Steel Name Stamps, &c. J.B. Roney, Lynn, Mass.

Treatise on gear teeth and bevel gears; specimen pp free. Geo B. Grant, 66 Beverly st., Boston, Mass

The Best Upright Hammers run by belt are made by W. P. Duncan & Co, Bellefonte, Pa.

R. Dudgeon, 24 Columbia st, New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Send for new catalogue of tools for amateurs; just out. Hartford Tool Co., Hartford, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts, New York.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John st., N. Y.

Drop presses, and other special tools, manufactured by Williams, White & Co, Moline, Ill.

Improved Labor-Saving Upright Drills: prices reasonable. Currier & Snyder, Worcester, Mass.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Foot-Power Machinery for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Light, fine, interchangeable mach'y to order. Foot athe catalogue for stamp. E.O. Chase, Newark, N.J.

Consulting Engineer and Mechanical Expert, C. C. Hill, 84 Market st., Chicago, Ill.

Lyman's Gear Chart. How to lay out gear teeth. Price, 50c. E. Lyman, C. E., New Haven, Conn.

Selden Packing for stuffing box, with or without rubber core Randolph Brandt, 38 Cortlandt st., N.Y.

Upright power hammers, unequaled for die work run at high speed. Williams, White & Co., Moline, Ill.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

Farley's Reference Directory of the Machinists', Iron, Steel and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st, Philadelphia, Pa.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co, Collinsville, Conn.

The outline ("wax process") engravings shown in the AM. MACHINIST each week are made by Struthers, Servoss & Co., 24 to 34 New Chambers St., N.Y.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-Taught;" $4. Books for workmen. Joshua Rose, Box 3306, New York City.

Wanted.—Mechanical Automatic Figures. Must be new and *original* design, and *work naturally*. Address, with full description and price, Lock Box B, Waterbury, Conn.

Morrison's Practical Engineer, a complete treatise on steam and general machinery. Price, $1; mailed free Indicators, Engineers' Instruments and outfits. W. A Morrison, Box 373, Lowell, Mass.

Where an ordinary hand-damper is used, we furnish Kellam's Antomatic Steam Damper Regulator, guarantee saving 7 to 10 per cent. in fuel and give 30 days' trial. Hine & Robertson, 12 Cortlandt st., N Y.

Locomotive Engine Running and Management. By Angus Sinclair. Gives full directions about handling and repairing locomotives; instructs how to design valve gear and set valves; Westinghouse air brake explained by aid of engravings. Price, $2. For sale by *National Car Builder*, 187 Dearborn st., Chicago, Ill.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.

MANUFACTURES

A co-operative bit factory is to be established at Ansonia, Conn.

W. H. Macy, Kissimmee, Fla., will establish a machine shop.

The Lexington (Ky.) Mfg. Co., will enlarge their hardware factory.

Clark & Adams are reported as putting up a machine shop in Elberton, Ga.

P. D. Parker is about to erect a $75,000 cotton compress at Birmingham, Ala.

James Withgott, of Easton, Md., and William Dillahay, will establish a machine shop.

It is said that the Boston & Maine Railroad will build a large roundhouse at Cambridge, Mass.

Brattleboro, Vt., people propose to form a $30,000 stock company to make W. M. Farrow's new gun.

A project is working to start a steel nail mill in Salem, Ohio. Stock is being taken in the enterprise.

Philips & Townsend, 2102 Brandywine street, Philadelphia, will erect a wire nail factory, to cost $5,000.

The foundry and machine shop of John Wood, Jr., at Conshohocken, Pa., recently burned, will be rebuilt.

The Chattanooga Iron Company, Chattanooga, Tenn., will blow out their furnace to repair and enlarge it.

Belser & Parker, Mitchell Station, Ala., are erecting a cotton seed oil mill, and also a ginnery and grist mill.

F. W. Wurster, South Sixth and First streets, Brooklyn, N. Y., will erect a new axle factory, to cost $4,800.

The Globe Shot Co., of Philadelphia and St. Louis, will erect works in Dallas, Texas, to cost about $25,000.

Longman & Martinez, 207 Pearl street, New York, will erect a 50x24 foot factory, three stories high, in Brooklyn.

The plow and wagon factory that Blount & Hill, of Atlanta, Ga., will erect at East Point, Ga., is to cost about $20,000.

The Dayton Coal and Iron Works, of Dayton, Tenn., will erect a steel plant as soon as they have completed their furnaces.

Huston & Mills, of Akron, Ohio, have purchased ground in Dayton, Tenn., on which to erect a foundry and machine shop.

The Huntingdon (Pa.) Car Works, with a first mortgage indebtedness of $35,000, will be sold under foreclosure in September.

It is estimated that at least 3,500 mechanics, who are in busy times employed at locomotive building in Paterson, N. J., are now idle.

Frank P. Flesh, of the Birmingham Stove Works, Birmingham, Ala., is endeavoring to establish a bolt and nut factory in that city.

It is claimed that the Pittsburgh Plate Glass Co., when in full operation, saves $1,000 per day by the change from solid to gaseous fuel.—*Progressive Age.*

About one-half of the New York and New England Railroad's extensive car shops in Norwood, Mass., were burned recently, causing a loss of over $100,000.

The Carteret Mills, Beaufort, S. C., are building a machine and pattern shop 30x60 feet; a foundry 20x50 feet, and a blacksmith shop 20x30 feet. They will be finished by October 1.

The Geddes blast furnaces, Syracuse, N.Y., which have been idle for more than a year, will start on September 1, with 100 men, with the expectation of employing 200 additional men in a short time.

Jesse Beech & Son, of Mason, Mich., will erect an agricultural factory at St. Louis, Mich., for which $1,000 has been voted by the Board of Trade and Village Board toward the establishment of the same.

Owing to an increase of orders, Mackintosh, Hemphill & Co., founders and machinists, Pittsburgh, will increase their working time from seven hours a day to ten, and will increase their working force to 300.

Samel L. Avery, Geo. C. Avery, and Wm. Henry Coen, of Louisville, Ky., have organized in that city the Kentucky Plow Co., capital stock, $50,000, to manufacture plows and other agricultural implements.

J. A. Mackinnon is opening a store at 22 Warren street, New York, for the sale of machinery tools and supplies. He will have a full electric light plant in the basement, to light his store and for purposes of exhibition.

The Advance Thresher Machine Company, of Battle Creek, Mich., will increase its capital from $100,000 to $150,000, and will add new machinery for the manufacture of steam road and thresher engines and threshers.

P. Pryibil, 461 to 467 West 40th street, New York, has issued a new catalogue of shafting, hangers pulleys, couplings, etc., fully illustrated. It contains rules for calculating speeds and diameters of pulleys, horse-power, driving power of belts, etc.

W. & L. E. Gurley, Troy, N. Y., have recently issued a new illustrated catalogue of engineers' and surveyors' instruments. It contains some valuable information for purchasers living at a distance, who may want to order for express shipment

Morse, Williams & Co., 411 Cherry street, Philadelphia, have purchased of E.W. Bliss, of Brooklyn, N. Y., all the patterns and machinery which he has used for the building of the Waldron rotary engine, and will build this engine in connection with their elevators.

The Cambria Iron Co., of Johnstown, Pa., are preparing to go into the manufacture of car axles. They have put in two of the Morgan and Williams steam hammers, and will shortly add lathes and other necessary machinery. They have already made several axles by way of experiment.

The Harrison Boiler Works, of Philadelphia, have issued a new illustrated circular of the Improved Harrison Safety Boiler. It describes the general construction, details of manufacture and advantages; also gives a long list of references to parties using these boilers, some of them for twenty years.

The *Manufacturers' Gazette* says the Lowell Co-operative Association, at its semi-annual meeting Saturday, in addition to six per cent. interest per annum on capital stock, and setting aside a handsome reserve, declared a dividend of four per cent. on shareholders' purchases for the half-year.

The Philadelphia Shoe Manufacturing Company has decided to build a new factory at Washington. The factory will be one of the largest in the country, and will accommodate 900 operatives. Work upon it will be begun at once, and it is expected to have it ready for the fall trade.

The Colwell Iron Works, foot of West 27th street, New York, whose iron lighthouse, constructed for the use of the U. S. Government at Delaware Breakwater, was noticed in the AMERICAN MACHINIST of August 1, are now negotiating with representatives of the Haytian Government for a similar lighthouse to be erected on the Island of Hayti, West Indies.

The Company operating the Riverside Worsted Mills at Providence, has joined with the Oswego Falls Manufacturing Co., with large worsted mills located twelve miles south of Oswego, N. Y., to form the Riverside and Oswego Mills Company, with a capital of $800,000, and Edward P. Chapin is president. The corporation will employ 3,200 persons.

The Mayor and Aldermen of Vicksburg, Miss., have finally accepted the proposition of the Louisville, New Orleans & Texas Railroad Co., and will submit the same to a vote of the people. If ratified, it will result in the building of extensive machine shops for the road at Vicksburg. R. T. Wilson, New York, is president of this road.—*Baltimore Manufacturers' Record.*

Two locomotives built in Paterson, were recently put in competition on the Buenos Ayres & Pacific Railway, in the Argentine Republic, with two made in Newcastle, England. The result was a decided victory for the Paterson locomotives, both as to speed and hauling freight. The entire road, 500 miles long, will be equipped with Paterson locomotives.

H. M. Caldwell, president of the Elyton Land Co., Birmingham, Ala., has closed a contract with the president of the Alabama Great Southern Railroad Co., to build in Birmingham the machine and car shops of this road. Ground 300x1,360 feet has been secured for the location.

Horace Thurston, who has carried on the machinery business for some months in Providence, R. I., has formed a partnership with Walter H. Stearns and Geo. S. Rider, under the firm name of Thurston, Stearns & Co. The works have been enlarged, and they will continue to design and construct special automatic machinery and fine tools. The works are at 419 Eddy street.

The Gardner Governor Co., Quincy, Ill., have issued a new illustrated catalogue showing the various styles of Gardner governor adapted to all classes of steam engines. They say in preface: "Having the largest governor factory in the world, with every modern appliance for accurate duplication of work, carrying a large and complete stock, we can fill orders promptly and satisfactorily." They also make a full line of stop valves. They are about to increase their force, owing to the many orders being received.

A patent for an Improved Surface Condenser has been lately taken out by Frederick M. Wheeler, of the Knowles Steam Pump Works. The design of this condenser does away with all forms of ferrules and packing for the tube heads, and yet allows the tubes to expand and contract freely. The circulation of the condensing water is very active, making the cooling surface more efficient than in the usual form of surface condensers. The tubes are straight and can be taken out, cleaned, and replaced by unskilled labor. The Wheeler Surface Condenser will be introduced by the Lighthall Manufacturing Co., of 97 Liberty street, New York.

We are informed that the Eclipse Wind Engine Co, Beloit, Wis., have shipped one 25′ pumping mill to Winchester, Mass, together with one 5″x 16″ Eclipse double-acting pump, with tank and fixtures, for village water-works at that place Also one 25′ geared mill to Manston, Wis. The home trade in small mills continues satisfactory. About as soon as a car is loaded and run out of the works another one takes its place, to be loaded to supply the foreign demand for 10′, 12′, 14′, and 16′ wind mills. Among other contracts, they have one to furnish a railroad in Michigan with 5 tanks 24′ in diameter and 20′ deep, and one tank 30′ in diameter and 24′ deep.

The new mill of the Edwards Manufacturing Co., Augusta, Me., is making rapid progress, and is expected to be completed and ready to start up by the first of next March. This extensive addition to the plant of the Edwards Company will double their present capacity, increasing it from 35,000 spindles to 70,000. A contract to the amount of about $260,000 for the necessary machinery to equip the mill has just been closed with the Saco Water Power Machine Company, Biddeford, whose works have been shut down nearly a year, owing to the depression in cotton manufacturing. This contract will insure the steady employment of a large force for some months, and work has already commenced.

The Boston *Commercial Bulletin* says: "The ten-hour movement in New Hampshire is not making much progress this year. The corporations are opposing it strongly, and the proposed measure is not very urgently supported. The manufacturers of the Granite State insist that the 1¾ hours of labor per week, which they get over the Massachusetts factories, serve to equalize the greater distance of New Hampshire from the markets, and from the cotton fields. It is claimed that the advantage which Manchester has hitherto derived from water power has been largely neutralized by the great improvements made in the use of steam during the last few years and the increasing uncertainty of the water supply itself.

A corporation under the general laws of the State has been organized in Manchester, N. H., under the name of the "Forsaith Electrical Machine Company," for the manufacture of dynamos, under the Whitney patent. The capital stock is $60,000, in shares of $100 each, and the officers are: Hon. Samuel N. Bell, president; Hon P. C. Cheney, vice-president; Hon. James A. Weston, treasurer; Judge N. P. Hunt, clerk; William E. Drew, agent; Hon. S. N. Bell, P. C. Cheney, D. B. Varney, A. P. Olzendam, Col. B. C. Dean, Stephen N. Bourne and W. E. Drew, directors. The company already has work in view amounting to $65,000, and it is confidently anticipated that a large and profitable business will be conducted.—*Boston Journal of Commerce.*

The Egan Co., Cincinnati, Ohio, write us: "Our business of manufacturing improved wood-working machinery for the past six months has held up fairly well. Times are close, and much more work has to be done to do the same business, but the volume of our business has been about the same as during the previous six months; prices being less, we must have sold fully 25 per cent. more machinery. The wants of the trade have taken a great change, especially in the quality of the goods called for. People formerly wanted something cheap; now they want the best for labor-saving and durability. We have within the last year introduced fully one dozen new machines, and the demand for these special tools has enabled us to really do more business than formerly. At present profits are very small, if any, but we are looking for an advance in prices in the near future. The large number of machines we make (over 300 different machines), and our special manufacturing facilities, give us a great advantage in making complete outfits for wood-working establishments."

Mr. D. A. A. Buck, formerly of this city, inventor of the Waterbury watch, says the Worcester *Spy*, also built an engine so small that, with boiler, governor and pumps, it would stand on a gold dollar. It was five-eighths of an inch high, had 148 separate pieces, held together by 52 screws, and three drops of water were required for the boiler. Diameter of cylinder, one-sixteenth inch; stroke, three thirty-seconds inch; total weight, 15 grains.

The American Steam Gauge Co., of Boston, have issued a 128-page illustrated catalogue and price-list of their productions, consisting of steam and hydraulic gauges, Thompson's and Richards' steam engine indicators, planimeters, pantographs, speed indicators, pop safety valves, and other steam supplies. The catalogue contains much useful information for engineers and steam users. They announce in the preface that their trade has continually increased for the past ten years, which they do not attribute to "any personal preferences for the officers of this company, but to the fact that we have always endeavored to produce an article that would meet all the requirements of our customers at a moderate cost." They are always willing to give information or do anything reasonable to accommodate customers, and when any article has not given entire satisfaction they have always made haste to rectify it. The price-list is neatly bound in cloth.

Machinists' Supplies and Iron.

New York, Aug 6, 1885.

There is nothing new in the condition of the supply business, or in manufacturing.

Iron—The market for American pig is without change. There is nothing doing except in the way of small daily sales to meet current wants. No 1 Foundry is held firm, but in other brands concessions are made to effect sales. This has a tendency to unsettle business, and make the outlook unsatisfactory. We quote for Standard Lehigh brands of No. 1 Foundry, $17.50 to $18; No. 2 X, $16; Grey Forge, $13.50 to $14 50.

Scotch Pig—Transactions are light, and as a consequence of the small demand, prices are very generally shaded. Quotations are merely nominal. We quote Shotts, $19.50 to $20; Coltness, $19.50 to $20; Glengarnock, $18 50 to $19; Gartsherrie, $19.50; Summerlee, $19 to $19.25; Carnbroe, $18.50 to $19; Eglinton, $17.50 to $18; Langloan, $19.50 to $20; Dalmellington, $18 to $18.25.

Copper—The market has ruled quiet and steady, with asking prices for Lake, 11¼c.; with 11c. to 11⅛c. offered; other brands are held at 10⅜c. to 10⅝c.

Lead—But little is offered at 4 30c., with some sales at 4.25c. Holders do not appear anxious to sell at these figures.

Tin—The inclination of prices is to favor buyers; there is more inclination to sell on the part of holders. Prices are easier in London, with considerable arriving here. Jobbing lots of Banca are quoted at 21c. to 21¼c; Straits and Malacca 22c. to 22¼c.

Antimony—Hallett's, 8 90c.; Cookson's, 9½c.;

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Situation as foreman or supt. of machine shop. Lock Box 568, Philadelphia, Pa.

Two first-class machinists want situation; state if open for both. Address W. & M., Am. Machinist.

Wanted—Situation as foundry supt. or foreman. Best reference. Address Founder, Am. Machinist.

Position wanted by a young man in a machinery salesroom; no objection to traveling. Address M. S., Am. Machinist.

Patternmakers Wanted — None but first-class workmen need apply. Deane Steam Pump Company, Holyoke, Mass.

Wanted—A first-class patternmaker on engine work. State where last employed, and wages expected. Address "Windsor," Am. Machinist.

Wanted—A position as mechanical superintendent or foreman in a manufactory, on light machinery or specialties, by a man of extended experience; is a skilled and complete machinist toolmaker, etc.; has had charge of a foundry and machine works; very experienced in electrical and experimental works; would prefer a situation in New England or middle States; salary not less than $2.500 per annum. Address M. A. J., Am. Machinist.

MISCELLANEOUS WANTS

Advertisements will be inserted under this head at 35 cents per line, each insertion.

The Cyclone Steam Flue Cleaner has no equal. Crescent Mfg. Co., Cleveland, Ohio.

One 20×48 Corliss engine, in good order, for sale by Henry I. Snell, 135 N. 3d st., Philadelphia, Pa.

Wanted—Live machinist with $3,000 capital to purchase interest (with salaried position) in established manufacturing business. Address Box 19, Verona, Pa.

If you want engines, boilers, or machinery of any kind, send your address to Henry I. Snell, 135 N. 3d st., Philadelphia, Pa.

To make room for larger tool, will sell cheap, for cash, a planer 42"x42"x12', in good order. Address P. O. Box 2085, Bridgeport, Conn.

CHANDLER & FARQUHAR,

177 & 179 Washington St.,

BOSTON, MASS.

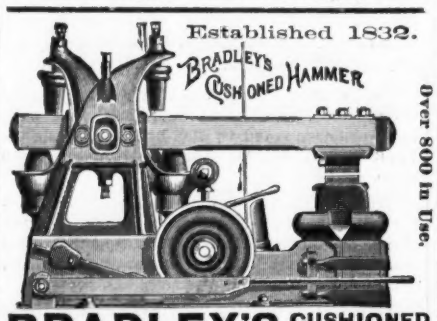
TOOLS AND SUPPLIES

—FOR—

Machinists, Plumbers, Gas Fitters, Electricians, Model Makers, Roller Skate Makers, Amateurs, etc.

Send for Catalogue B.

Established 1832.



Over 800 in Use.

BRADLEY'S CUSHIONED HAMMER.

Stands to-day without an Equal.

It approaches nearer the action of the Smith's Arm than any Hammer in the WORLD.

SPECIAL NOTICE.

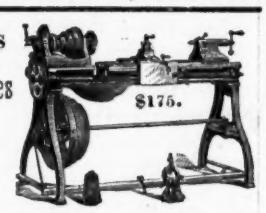
All parties making, selling or using an Upright or Helve Power Hammer having a Cushioned Vibrating Saddle, infringe our patents, and we shall hold them legally liable for the same.

BRADLEY & COMPANY, Syracuse, N. Y.

SEBASTIAN, MAY & COMPANY'S

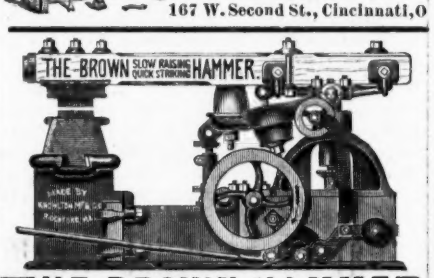
Improved Screw Cutting

Foot or Power Lathes



Catalogue of Lathes, Drill Presses and Machinists' Tools and Supplies mailed on application. Lathes on Trial.

167 W. Second St., Cincinnati, O



THE BROWN HAMMER

STRIKES A BLOW WITH

DOUBLE THE VELOCITY That it Raises the Hammer

A NEW MOVEMENT! SEND FOR DESCRIPTION

KNOWLTON MFG. CO., King St., Rockford, Ill

251 *pages, 6 plates, 58 illustrations, 8-vo, cloth.* $5.00.

TREATISE ON

VALVE-GEARS

WITH SPECIAL CONSIDERATION OF THE

LINK-MOTIONS OF LOCOMOTIVE ENGINES,

BY DR. GUSTAV ZENNER.

Translated from the fourth German edition,

BY PROFESSOR J. F. KLEIN.

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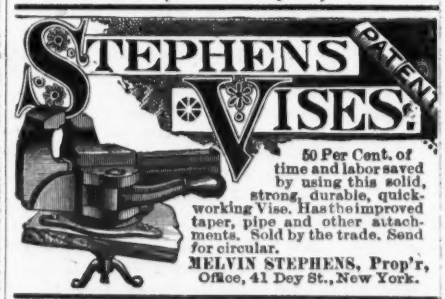

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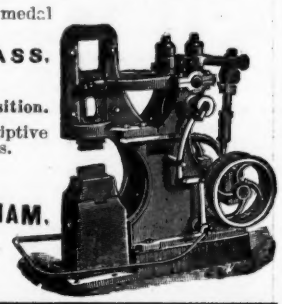

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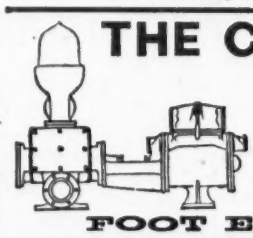

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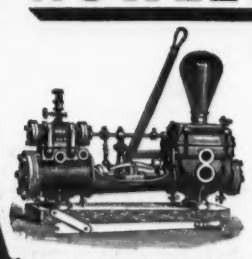

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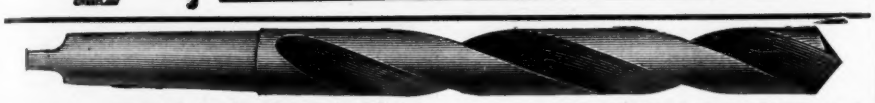

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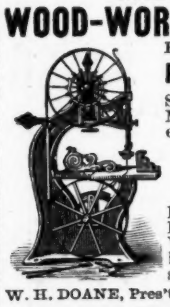

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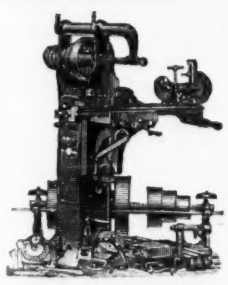

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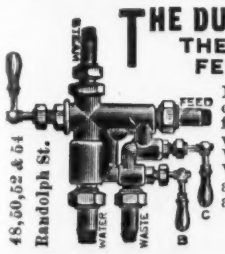

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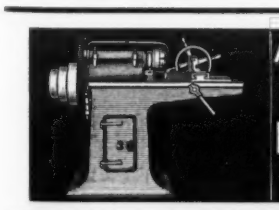

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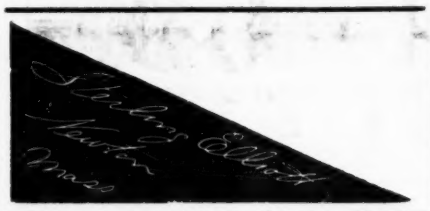

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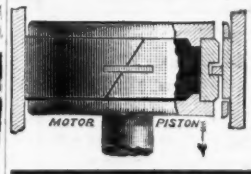

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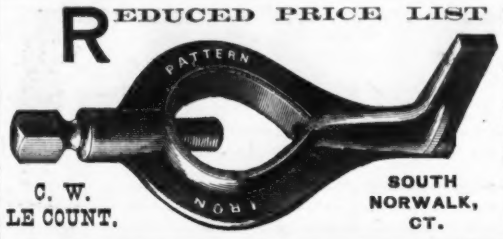

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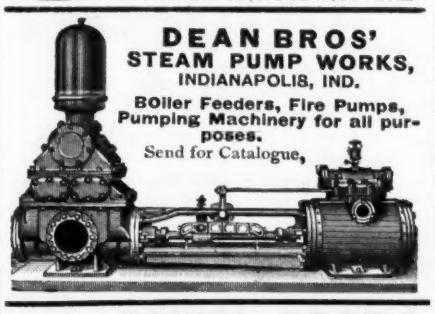

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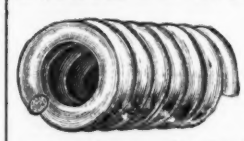

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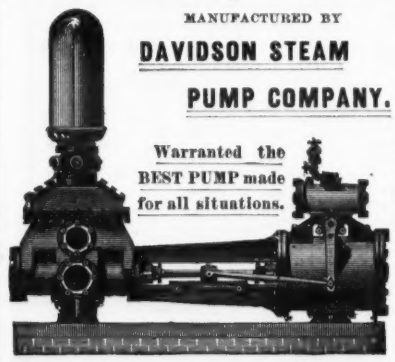

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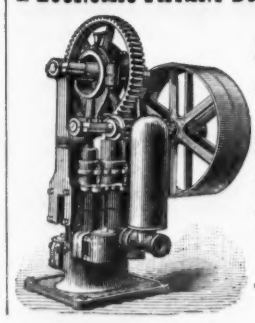

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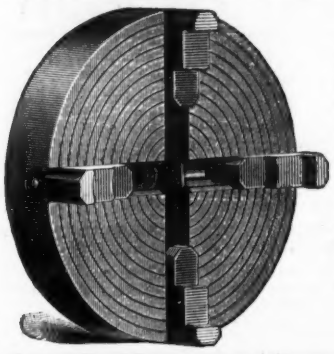

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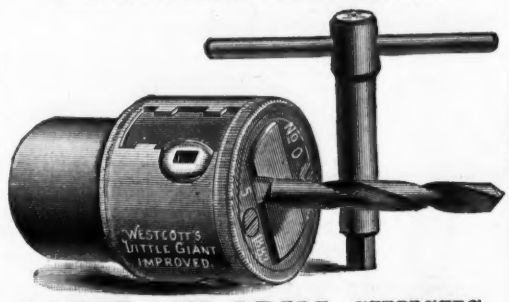

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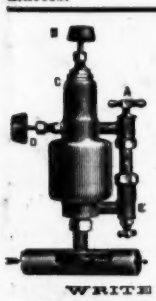

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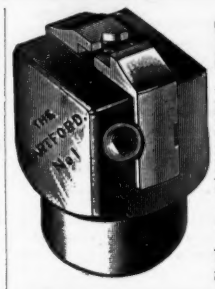

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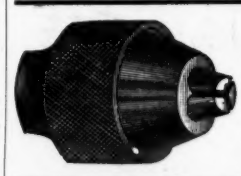

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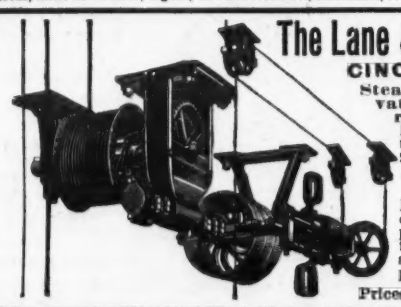

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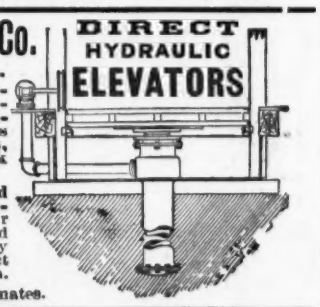

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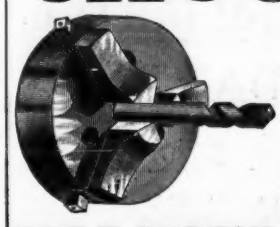

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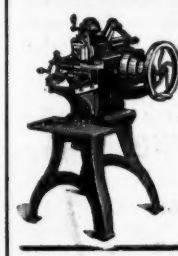

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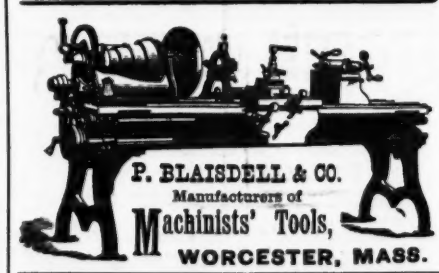

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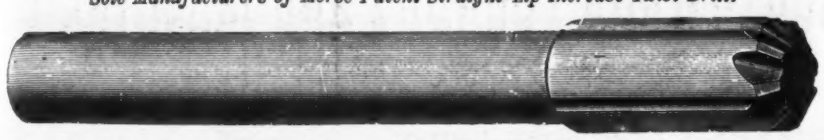

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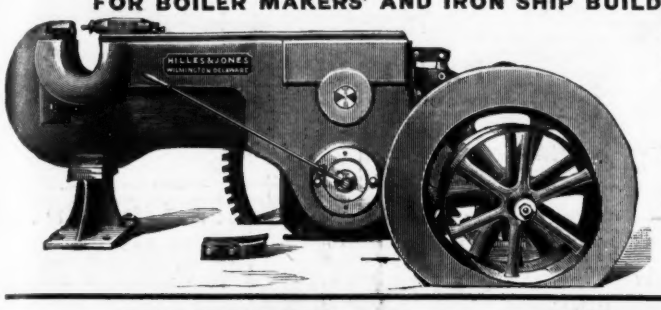

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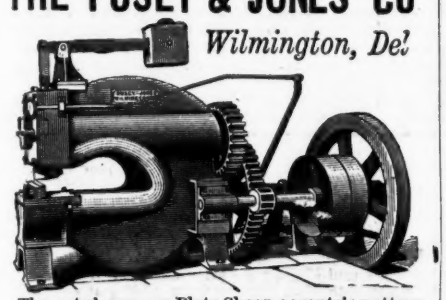

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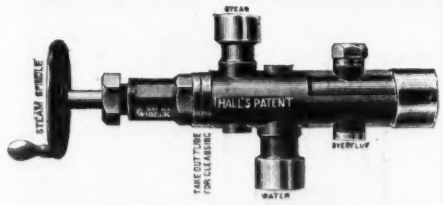

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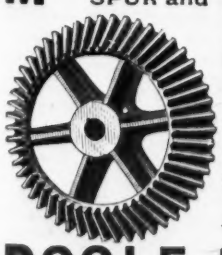

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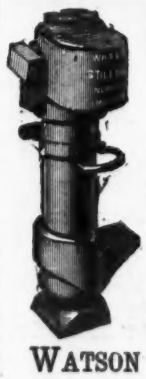

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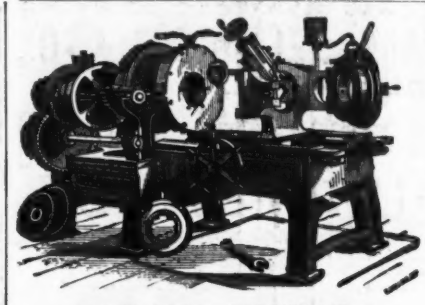

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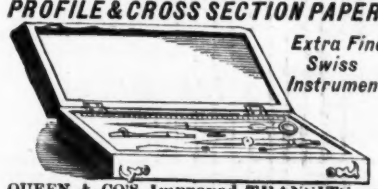

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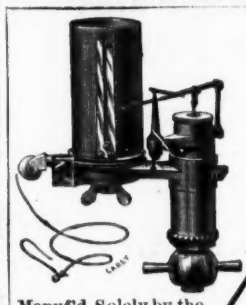

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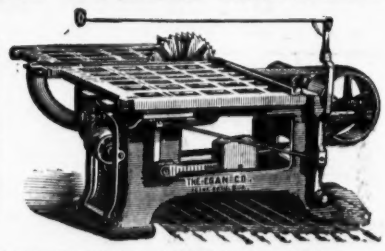

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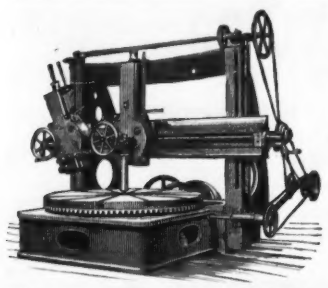

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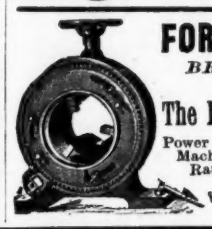

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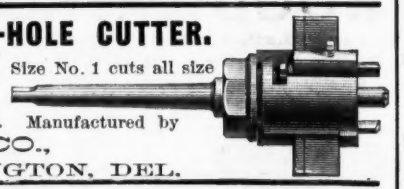

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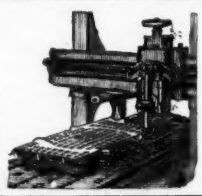

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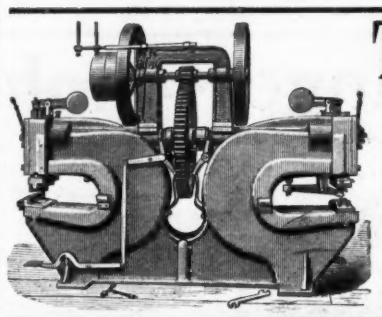

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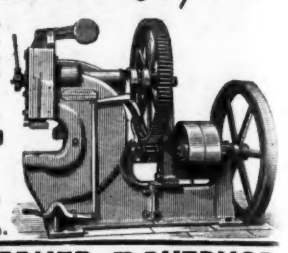

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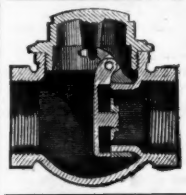

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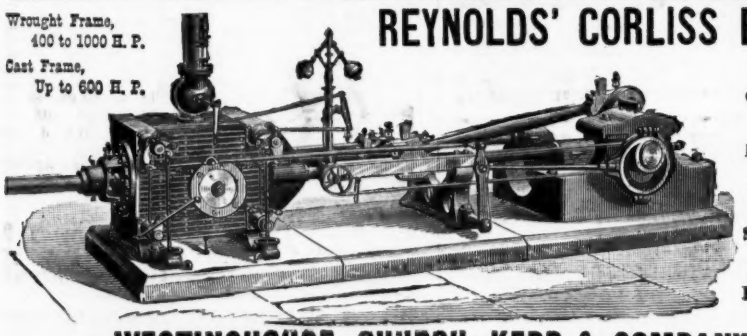

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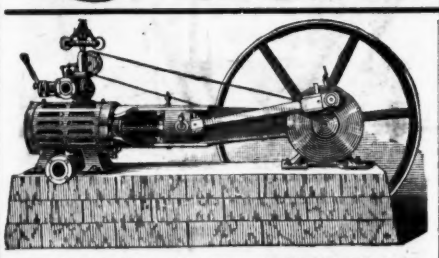

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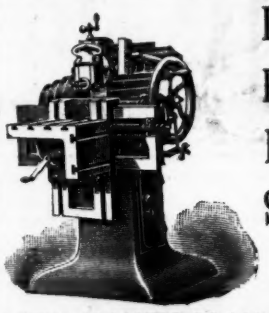

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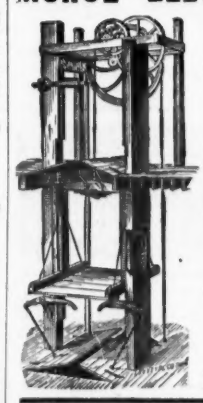

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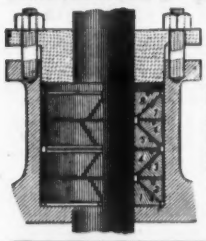

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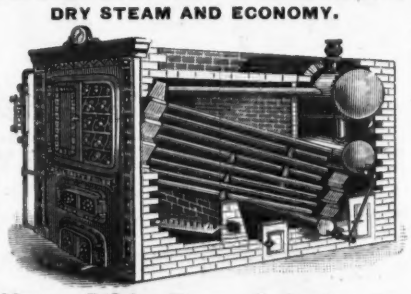

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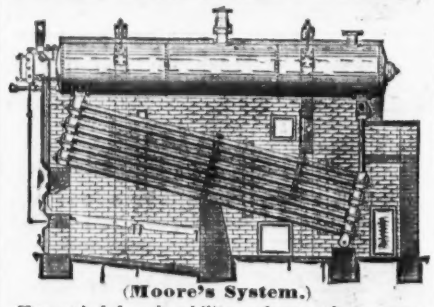

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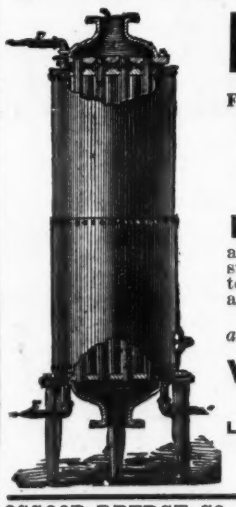

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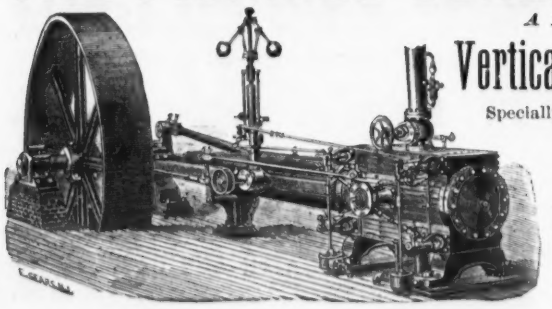

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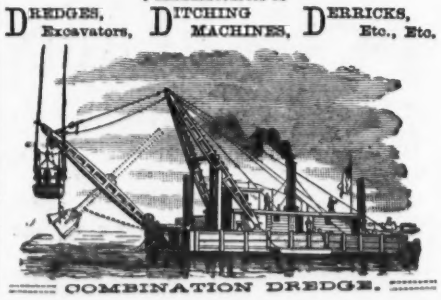

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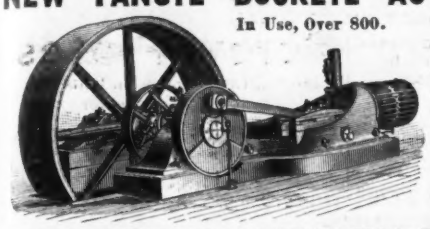

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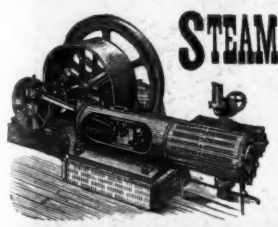

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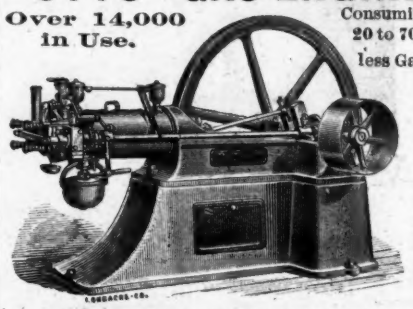

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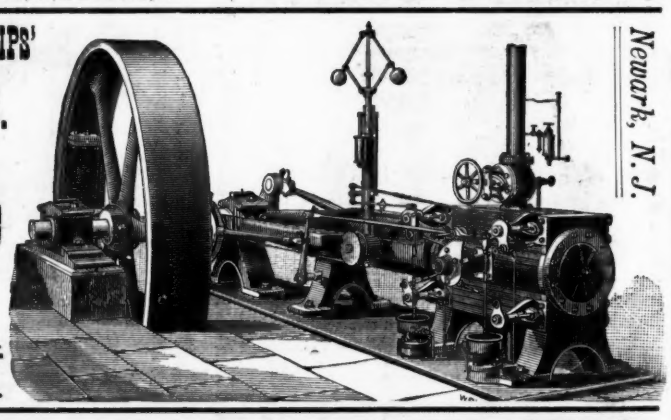

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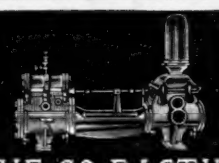

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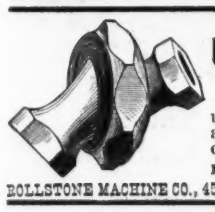

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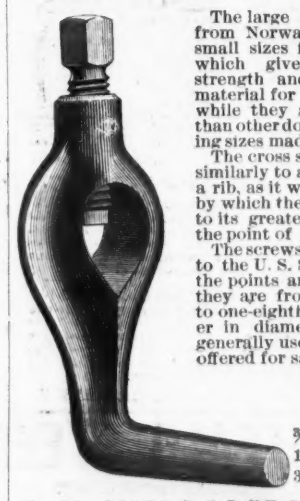

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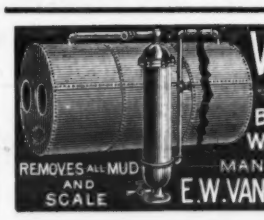

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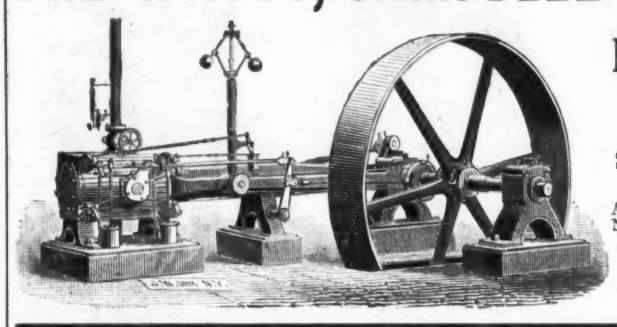

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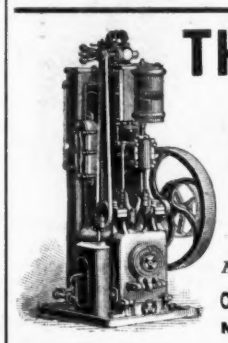

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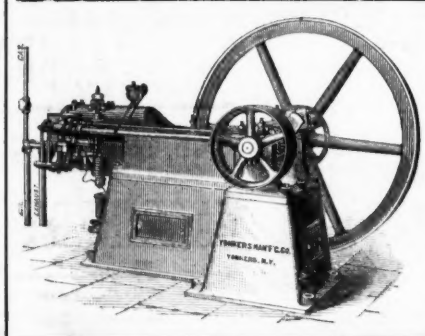

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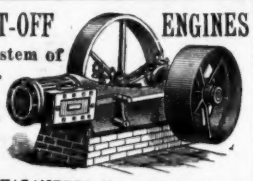

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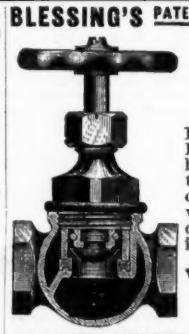

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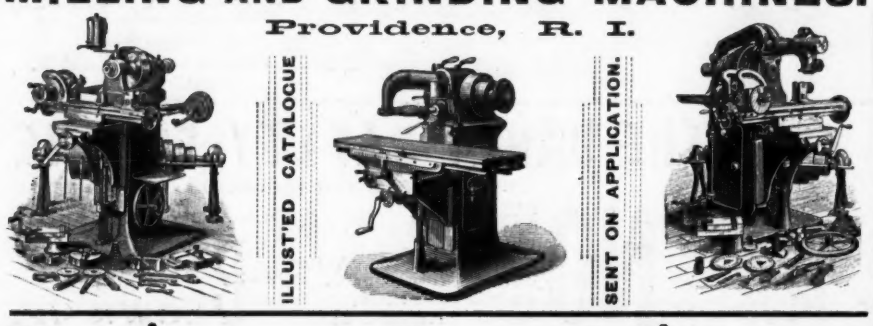

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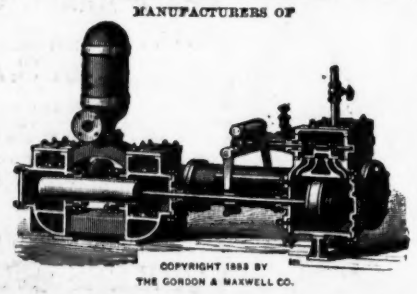

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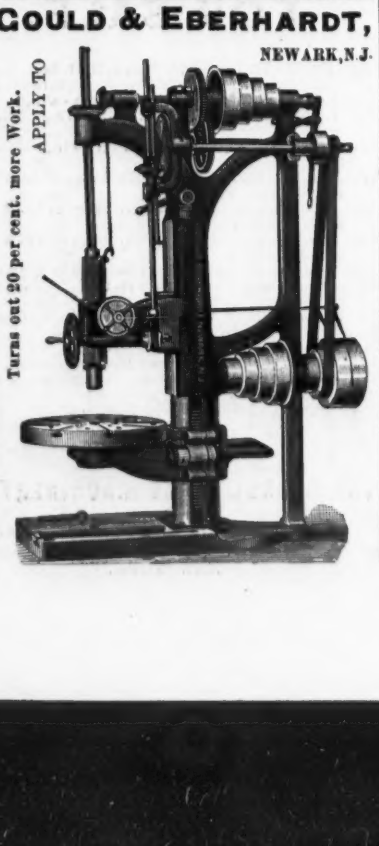

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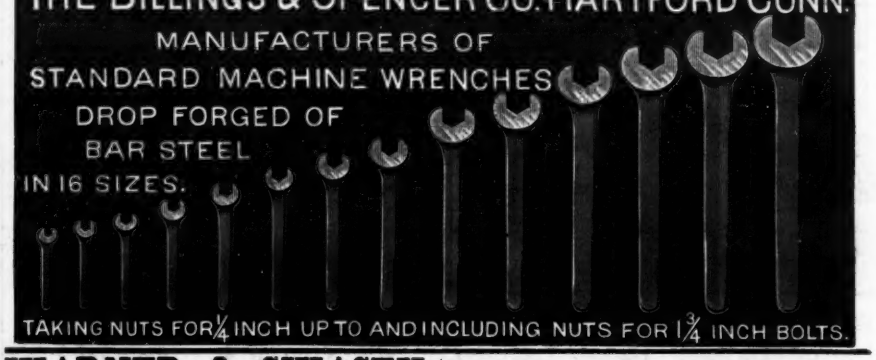

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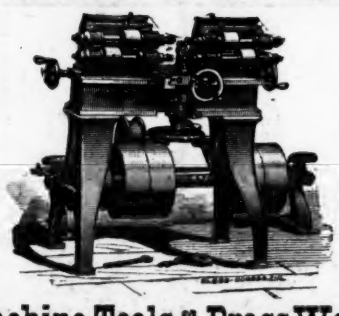

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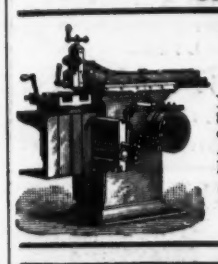

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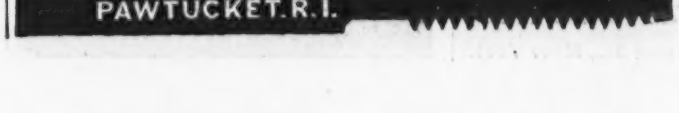

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